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CHEMICAL POTENTIALS IN GEORGIA

A Handbook of Resources and Opportunities

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Foreword

Georgia has the resources necessary for attracting and fostering the growth of a substantial chemical industry within the state. This is borne out by the fact that more than 300 chemical firms were in operation in the state in 1960, and growth of the industry has continued at an accelerated rate since that time.

Until recently, however, a major segment of the chemical industry was essentially precluded from taking advantage of Georgia's many resources and opportunities by the presence of one overriding liability -- the 3% sales and use tax on production equipment going into manufacturing plants. For years the almost complete lack of growth in the state of chemical manufacturing operations which require a large capital investment per employee contrasted sharply with the substantial development of this sector of the chemical industry in neighboring states.

The tax in question was modified in 1962 and revoked early in 1963. During the year following the modification of the tax, $40 million worth of chemical plant construction was announced for the state. Data are not yet available for 1963. Removal of the tax not only has provided a direct incentive for high-investment industrial growth, but also reflects an attitude of government which is distinctly favorable to expansion in all phases of the industrial economy.

The study upon which this handbook is based was begun before the tax change occurred, but work was suspended for some months when it became evident that the elimination of the inhibiting tax would be necessary before any completion of information on Georgia's resources would be useful or any evaluation of Georgia's chemical industry potentials could expect to secure results. The study was resumed soon after the tax was removed. At the same time, the scope of the study was broadened to provide a much more comprehensive compilation of data than was originally contemplated.

The undertaking of the study initially was made possible by special contributions from the following: First National Bank of Atlanta, Savannah District Authority, Georgia Ports Authority, Georgia Power Company, Trust Company of Georgia, Central of Georgia Railway, Georgia Department of Industry and Trade, and the Tennessee Corporation. Our special thanks are extended to each. Enlargement of the study was considered to be sufficiently critical to warrant the investment of our basic research funds in completing the project.

With this broad survey as a base, the Industrial Development Division hopes to be able to carry out a series of special studies in the chemical field in the months ahead. Comments regarding the contents of this report and inquiries regarding the special studies to be undertaken will be welcomed.

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Summary

While raw materials seemed to be the dominant factor in locating chemical plants in the decade preceding 1960, more emphasis is now being placed on the significance of maturing regional markets. This general trend has had a stimulating effect on the development of the chemical industry in the Southeast. In Georgia, the over-all effect has been modified by two developments:

1. Manufacturers who build plants with a large capital investment per employee, such as synthetic fiber plants, have tended to avoid locating in Georgia, although they have built in each of the five surrounding states. Since Georgia has sites with good water, utilities, and transportation facilities, surpassing many of those on which plants have been built in surrounding states, the tendency can be attributed largely to the 3% use tax which Georgia levied prior to 1963.

2. Formulated chemical product plants serving the southeastern market have tended to locate in Georgia. The important growth of this segment of Georgia's chemical industry may be attributed to the state's central location in the Southeast and to the state's transportation complex, which can efficiently serve the Southeast.

The growth of formulated chemical products plants in Georgia in turn has had two important effects on the development of other segments of the chemical industry in the state:

1. It has facilitated the production in Georgia of a variety of basic and intermediate chemicals to supply the chemical formulators.

2. It has emphasized Georgia's pre-eminent position as a distributor to the Southeast, thereby causing out-of-state chemical manufacturers to promote their own products by providing efficient service to sites in Georgia, specifically by establishing warehouses and sales offices in the large cities of the state.

Georgia's advantageous location for the distribution of consumer chemicals to the Southeast is evidenced by the fact that Atlanta is the fifth largest chemical wholesaling center in the United States. Some 41 million people live in the area to which products can be shipped more cheaply from Atlanta than from either Chicago or New York. A warehouse in Atlanta can ship to this market for 30% less than an optimum arrangement of warehouses

in Chicago and New York. Atlanta also offers more potential freight savings than Charlotte, Houston, New Orleans, and Memphis on chemicals shipped to consumers who live within 400 miles of each city.

Georgia's three deepwater and three inland ports offer advantages to companies which require water transportation at sites for the manufacture and distribution of industrial chemicals. For example, within the geographical area served more cheaply from Savannah than from New Orleans or New York are located 2,059 textile mills which produced $2.5 billion in value added by manufacture in 1958, or 52% of the value added by all textile mills in the United States. More than 40% of the nation's textiles are manufactured within 300 miles of Savannah.

The seven-state area comprising Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee, and Virginia produced 43% of the national wood pulp output and 30% of the national paper and board output in 1962. Georgia contributed about one-quarter of the area's output in both categories.

Savannah has a clear advantage over other southeastern ports for serving the pulp and paper industry. For serving the textile industry, analysis shows that Savannah is more desirable than Jacksonville, Florida, or Wilmington, North Carolina, and just as desirable as Charleston, South Carolina.

Georgia's strategic location in relation to the southeastern market is supplemented by the following resources for the development of the chemical industry in the state:

1. Transportation Resources. Brunswick, St. Marys-Kings Bay, and Savannah -- Georgia's three deepwater ports -- are among the westernmost U. S. coastal cities on the Atlantic Ocean and have the most direct approach to the mid-continental U. S. of any cities on the Eastern Seaboard. These three ports and the inland port of Augusta, located 197 miles from Savannah on a nine-foot channel in the Savannah River, have access by barge to cities on the Eastern Seaboard via the Atlantic section of the Intracoastal Waterway. Two other inland ports on nine-foot channels -- Columbus, on the Chattahoochee River, and Bainbridge, on the Flint River -- connect via the Gulf section of the Intracoastal Waterway to the mid-continental inland waterway systems. All six cities are shown on Map 6.

Plateaus extending from Georgia to the Midwest and from Georgia up the Eastern Seaboard make possible low cost railroad operation to a large part of the nation. Thirty carriers, 11 of which are Class I railroads, operate about 5,800 miles of track in Georgia. All but 11 of the state's 159 counties are serviced by rail routes. (See Map 8.) Piggyback service is available at 21 cities in Georgia.

Rail terminals within the state are particularly well situated for serving the Southern Classification Territory, comprising all or part of the 11 states east of the Mississippi River and south of the Ohio River. They can also compete in other areas on the basis of speed of delivery. Shipments from Atlanta, for example, reach eastern points as quickly as shipments from Chicago, and they reach midwestern points as quickly as shipments from New York. Transit times on shipments from principal points in Georgia other than Atlanta seldom exceed Atlanta's service by more than one day. Frequently transit time is the same or less than from Atlanta.

Seven transportation companies operate pipelines in Georgia. Natural gas pipelines operated by Southern Natural Gas Company, South Georgia Natural Gas Company, and Transcontinental Gas Pipe Line Corporation are shown on Map 10. Map 11 shows a portion of the petroleum products pipeline systems operated by Colonial Pipeline Company (under construction), Plantation Pipe Line Company, and Southeastern Pipe Line Company, and the liquefied petroleum gas line operated by Dixie Pipeline Company.

Highway transportation derives the same benefits as rail transportation from Georgia's position at the intersection of the midwestern and Eastern Seaboard plateaus. Also, because of the state's equable climate, days when roads are impassable due to snow or ice occur infrequently, and only in north Georgia.

The existing mileage of highways, roads, and streets in Georgia totaled some 97,000 miles in 1960, or 166 road miles per 100 square miles -- far more than the national average of 117. The National System of Interstate and Defense Highways will include 1,128 miles of four-lane, limited-access highways in Georgia, and 30 cities with populations of at least 5,000 are expected to be on or within a few miles of the planned routes.

Georgia is served by 100 scheduled motor carriers, plus 400 irregular route carriers, contract haulers, and specialized commodity carriers. The number of carriers providing direct service from Atlanta to principal cities in the U. S. is shown in Map 13. At least 30 Georgia cities are served by a minimum of 22 motor carriers having certificated interstate operating rights to transport "general commodities."

Normal motor freight transit times in days for shipments from Atlanta are shown on Maps 14 and 15. The geographical areas to which truckload shipments may be sent overnight from each of six other Georgia cities are shown in Map 16.

Thirty cities in Georgia maintain at least one paved and lighted airport; 12 of these are served by regularly scheduled commercial flights. (See Maps 17 and 18.) Six of the nation's 11 trunk airlines (Delta, Eastern, National, Northwest Orient, Trans World, and United) and two regional airlines (Piedmont and Southern) serve Georgia.

2. Raw Materials Resources. Chemical manufacturers who have located in Georgia to serve the southeastern market produce a variety of basic and intermediate chemicals ranging from chlorine, caustic soda, inorganic acids, ammonia, nitrogen, and metallic oxides to emulsifiers, organic pigments, rosin and tall oil derivatives, and fine chemicals. Hydrochloric and sulfuric acids have especially low prices in Georgia.

Purchasers of chemicals which are sold on a freight allowed or delivered cost basis can benefit from a Georgia location because of the service offered by the complex of chemical distributors in Atlanta. Large volume chemicals sold on a freight equalized basis are listed in Table 11 along with manufacturing points of freight equalization nearest to Georgia.

Georgia has more than 30 minerals or mineral products that appear to be economically important. Of this number, only 18 are presently in production. In 1960, Georgia was first in the nation in the output of kaolin, marble, and crude iron oxide pigments; second in fuller's earth output; third in barite and mica production; and fourth in feldspar output.

Other minerals presently produced include bauxite, portland cement, coal, glass sand, iron ore, limestone, manganese ore, peat, and talc. Minerals of potential value include asbestos, beryl, copper, gold, lead, pyrite, zinc, heavy minerals, kyanite and sillimanite, petroleum and natural gas, and tripoli.

Georgia's forest resources include commercial forest land totaling 25.8 million acres, or 69% of the state's land and water area. Pines compose the major part of the state's forests. (See Table 12.) Excess of annual growth of the state's commercial forests over total drain (annual cut plus loss due to fire, insects, and other natural causes) was estimated at 168 million cubic feet in 1961.

3. Water Resources. Georgia's five major river systems -- the Coosa, Chattahoochee, Flint, Savannah, and Altamaha -- along with several smaller rivers discharge 39 billion gallons of water a day, largely directly into the Gulf of Mexico or the Atlantic Ocean. Differences in annual rainfall, varying from a high of 70 inches in the 5,000-foot elevations of the Blue Ridge province in north Georgia to a low of 43 inches in south central Georgia, and physiographic factors cause great variations in quantity and quality of surface water resources throughout the state. Map 20 shows the locations of 35 selected gauging stations in the state for which information on flow, chemical characteristics, and temperature is presented in Tables 14, 15, and 16, respectively.

Georgia has large, although unmeasured, ground water resources which occur in five distinct aquifers. The three aquifers of the Coastal Plain province and the one in the Valley and Ridge province of northwest Georgia are the most productive in the state. Yields of 1,500 gallons per minute are not uncommon in these four aquifers; individual springs are recorded as producing as much as 16,000 gallons per minute. Ground water temperatures are consistent the year round, and quality is generally acceptable to the chemical industry. (See Table 17.)

4. Other Resources. Installed electric power generating capacity in Georgia has increased nearly 130% during the past 10 years, and further expansion is underway to meet increasing requirements. Generating facilities, transmission lines, and primary distribution lines in the state are shown on Map 22. Typical monthly industrial electric bills for 64 U. S. cities are compared in Table 18.

Natural gas fulfills most industrial fuel requirements in Georgia, providing more therms per year than coal, fuel oil, and liquefied petroleum gas combined. Costs for these competitive fuels in five major Georgia cities are

presented in Table 19. Natural gas costs are low in Georgia because of the state's proximity to the productive fields in the mid-continental South. (See Table 20.)

Large, level sites suitable for chemical plants are relatively scarce in north Georgia. At present there are none on navigable water. In south Georgia a number of large, level sites on navigable water are available. These generally have access to good ground and surface water supplies. Potential site areas with access to roads, rivers, and railroads are shown on Map 24 and identified in Table 22.

There are 82 jobbing and repair machine shops and more than 100 consulting engineering firms in Georgia which offer technical service in such diverse areas as communication systems and corrosion control. Technical services are available for all aspects of the chemical specialties industry, including formulation, testing, evaluation, label compliance, registration, and technical sales promotion.

Most major vendors of processing equipment or packaging supplies maintain distribution facilities in the state, and some manufacture selected products, including metal, plastic, and glass containers. A total of 88 plants manufacture paper, fiber, or wood containers in Georgia.

The Georgia Institute of Technology performs well over $4 million worth of research annually, a large part of which is applicable to the chemical industry. Among the chemical companies which have been served by Tech are American Cyanamid Company, E. I. du Pont de Nemours & Company, Inc., Monsanto Chemical Company, and Union Carbide Corporation. The University of Georgia in Athens and Emory University in Atlanta also maintain extensive research facilities. More than 100 Georgia firms operate research or testing facilities.

Eighteen fully accredited universities and colleges in Georgia offer degrees in chemical engineering or chemistry. The state has a total of 64 institutions of higher education located in 36 counties, as well as a rapidly growing complex of vocational and technical schools. In the year ending June 1962, Georgia institutions conferred 169 bachelor's degrees, 26 master's degrees, and 10 doctorates in chemical engineering or chemistry. In 1963, Georgia Tech alone granted 16 of its 31 doctorates in chemical engineering or chemistry.

Surveys have shown that Georgia Tech graduates (presently numbering almost 28,000) prefer employment in Georgia. One recent survey showed that more than 80% of the June 1962 graduating class preferred or were willing to accept employment in Georgia. Another showed that nearly 30% of the 1946 to 1957 graduates had considerable interest in relocating in Georgia; another 42% were interested, but with qualifications.

To meet the growing need for chemical production workers there is a minimum of 250,000 Georgians potentially available for employment. Gross hourly earnings in Georgia's chemical industry ranged between 72% and 82% of wages paid by the industry nationally, according to Bureau of Labor Statistics reports for March 1961. Overtime and late shift premiums and paid leave time, as well as other components of total labor costs, are generally less liberal in the South than in other regions. Georgia has a good work stoppage record and reasonable labor laws and regulations, including a right-to-work law.

The wide variety of specific chemical manufacturing opportunities which are likely to be more profitable in Georgia than at other locations can be divided into three groups.

1. Chemical products which are oriented to consumer markets are almost always good prospects for profitable manufacture in Georgia, because the state is the natural center of any southeastern market related to the distribution of population. Examples of such products are detergents, household waxes and polishes, toiletries, pharmaceutical preparations, antibiotics, and paints.

2. Chemicals which are sold largely to the Southeast's traditional industrial markets -- the textile industry and the pulp and paper industry -- and to agriculture, as well as to Georgia's growing formulated chemical product complex, are also likely to be produced profitably in Georgia. Obvious opportunities are synthetic fibers and chlorine and caustic soda.

3. Selected chemicals which traditionally have been manufactured at raw material oriented sites offer opportunities which are often overlooked. Analyses have shown that some of these chemicals can be more profitably produced in Georgia than at raw material outlets. This is because the combination of large and growing southeastern markets and low cost transportation for bulk commodities has made it more profitable to transport raw materials to market oriented sites in the Southeast than to transport finished products

to the Southeast from raw material oriented sites. Examples of chemicals in this category are synthetic rubber and natural gas products (methanol, formaldehyde, and methylamines; acetylene and acetylene chemicals; and methylene dichloride and perchloroethylene).

Part I

GEORGIA'S POSITION IN THE SOUTHEASTERN MARKET

THE IMPORTANCE OF MARKETS IN THE DEVELOPMENT OF GEORGIA'S CHEMICAL INDUSTRY

Recent announcements of chemical plant construction indicate that a new pattern in plant location is developing in the industry. While raw materials seemed to be the dominant factor in locating plants in the decade preceding 1960, more emphasis is now being placed on the significance of maturing regional markets. In the case of formulated chemical products, the trend has been toward constructing regional branch plants instead of expanding existing facilities.

In the Southeast, raw materials have not played a large part in attracting industry, except in the pulp and paper industry. Yet the area is bustling with the building activity of chemical processors who intend to serve the regional market more effectively. Some want to supply the Southeast's traditional industrial markets -- the pulp and paper industry and the textile industry -- and agriculture. Others want to save on distribution costs to growing consumer markets. The in-migration of chemical formulators has attracted producers of chemical intermediates.

In many respects, the general development of the chemical industry in Georgia has been similar to that of other states in the Southeast. Market oriented manufacturers have prospered by importing raw materials via Georgia's ports, rails, highways, and pipelines and by distributing to the southeastern market through the same transportation complex. Basic materials presently used by Georgia's chemical industry include natural gas, salt, and sulfur, which are brought into the state, and naturally occurring forest resources, bauxitic clays, and silicates.

Specific developments in Georgia's chemical industry in recent years have differed -- at least in degree -- from the general southeastern trend, however.

Manufacturers who build plants with a large capital investment per employee, such as synthetic fiber plants, have tended to avoid locating in Georgia, although they have built in each of the five surrounding states. Since Georgia has sites with good water, utilities, and transportation facilities, surpassing many of those on which plants have been built in surrounding states, the tendency can be attributed largely to the 3% use tax which Georgia levied prior to 1963. (See Foreword.)

On the other hand, formulated chemical product plants serving the southeastern market have tended to locate in Georgia. The important growth of this segment of Georgia's chemical industry may be attributed to the state's central location in the Southeast and to the state's transportation complex which can efficiently serve the Southeast.

The growth of the formulated chemical industry in Georgia in turn has had two important effects on the development of other segments of the chemical industry in the state.

First, it has facilitated the production in Georgia of a variety of basic and intermediate chemicals ranging from chlorine and sulfuric acid to emulsifiers and organic pigments. For example, when Procter and Gamble Company built a detergent plant in Augusta to serve the southeastern market, Monsanto Chemical Company built a sodium tripolyphosphate plant and E. I. du Pont de Nemours and Company built a sodium silicates plant to supply raw materials. While the pulp and paper industry, the textile industry, and agriculture purchase the bulk of the basic and intermediate chemicals produced in Georgia, the formulating industry has provided an attractive additional market.

The second effect has been to emphasize Georgia's pre-eminent position as a distributor to the Southeast, thereby causing out-of-state chemical manufacturers to promote their own products by providing efficient service to sites in Georgia, specifically through establishing warehouses and sales offices in the large cities of the state. In the early 1950's, for example, several nationally known paint manufacturers established southeastern plants in Georgia. Atlanta has since become an important warehousing center for paint-making materials.

As a location for both manufacturing operations and distribution facilities, Georgia offers the chemical industry the potential for continued and accelerated growth. The economic advantages of distributing chemicals from Georgia locations to the southeastern market provide the foundation and the other resources of the state provide the framework for the development of a strong chemical industry in Georgia.

DISTRIBUTION OF CHEMICALS FROM GEORGIA LOCATIONS

The chemical industry is experiencing a growth in the number of points from which it ships. In the past a manufacturer could ship an item to customers throughout the country from one East Coast plant, but today, because of expanded markets and competitive conditions, he is likely to ship the same item from several warehouses or plants located at strategic points throughout the country.

A West Coast shipping point is usually essential to successful distribution because of the broad unpopulated area which separates that part of the country from the East. The division of the eastern United States into shipping territories is a more complex problem. Operating costs for each additional shipping point must be weighed against savings in freight costs. Frequently the possibility of increased sales due to more efficient service to customers is the factor which precipitates the addition of new shipping points.

In order to present any meaningful information on the distribution of chemicals from Georgia locations, it is necessary to restrict the range of possible considerations. First, the information in this chapter is restricted to two distribution situations: (1) the distribution of formulated products, such as detergents, which are sold to the ultimate consumer, and (2) the distribution from a deepwater port of industrial chemicals, such as chlorine, which are sold to the textile industry or the pulp and paper industry.

Second, detailed information is presented on only one Georgia city in each distribution situation: Atlanta is the only Georgia city for which information on the distribution of consumer chemicals is presented, and Savannah is the only Georgia city for which information on the distribution of industrial chemicals is presented.

Third, the comparative figures presented are based on the assumption that two shipping points already serve the East. In the case of consumer chemicals, it is assumed that all of the U. S. population east of the Rocky Mountains is presently served from shipping points in Chicago and New York. In the case of industrial chemicals, it is assumed that the U. S. textile and pulp and paper industries are presently served from New Orleans and New York. The assumptions are not intended as recommendations of Chicago and New York or New Orleans and New York as the best combinations of two East Coast

shipping points for consumer chemicals or industrial chemicals, respectively. They merely provide a framework for comparison and, in the case of consumer chemicals, recognize a likely situation.

Distribution of Consumer Chemicals from Atlanta

According to the 1958 Census of Business, only four metropolitan areas wholesaled more drugs, chemicals, and allied products (SIC 502)[1/] than Atlanta in that year. The top 10 chemical wholesaling cities and their sales in 1958 are shown in Table 1.

Table 1

THE TOP TEN METROPOLITAN AREAS IN WHOLESALING OF DRUGS, CHEMICALS, AND ALLIED PRODUCTS

Metropolitan Area	Number of Wholesaling Establishments	1958 Sales (in $1,000)
New York, N. Y.	1,517	3,892,875
Chicago, Ill.	594	1,563,635
Los Angeles-Long Beach, Cal.	604	889,678
Philadelphia, Pa.	287	727,081
Atlanta, Ga.	136	459,352
San Francisco, Cal.	259	444,179
Cleveland, O.	189	440,791
Boston, Mass.	251	406,259
Detroit, Mich.	229	369,535
Charlotte, N. C.	59	368,693

For some products, other cities in Georgia fall within Atlanta's wholesaling area, as do other cities in the South, such as Birmingham, Memphis, Jacksonville, Miami, St. Petersburg, and Tampa. Savannah ranked second to Atlanta among Georgia cities, wholesaling about $20 million of drugs, chemicals, and allied products in 1958. Sales in the non-Georgia cities ranged

1/ Standard Industrial Classification Manual, Executive Office of the President, Bureau of the Budget, Office of Statistical Standards, 1957.

from $29 million for the Tampa-St. Petersburg conurbation to $91 million for Memphis.

The following sections present information on (1) freight bill savings accruing from the establishment of a shipping point in Atlanta when the only other East Coast shipping points are in Chicago and New York, and (2) the population density of the markets served by Atlanta and four other southern cities -- Charlotte, Houston, Memphis, and New Orleans.

Atlanta Compared with Chicago and New York

Map 1 shows two equal-shipping-cost lines on a U. S. population distribution background. The area southeast of the dotted line can be shipped to more cheaply from Atlanta than from Chicago. The area southwest of the solid line can be served more cheaply from Atlanta than from New York.

Some 41 million people[1/] live in the area south of both lines -- the area more cheaply served from Atlanta than from either Chicago or New York. As the following analysis demonstrates, a warehouse in Atlanta can ship to this area for 30% less than an optimum arrangement of warehouses in Chicago and New York.

Table 2 shows the comparative freight bill analysis. Columns (1) and (2) list the 59 Census-defined metropolitan areas within Atlanta's freight advantage area. Column (3) lists the total population assigned to each metropolitan area by the following formula:

$$\frac{\text{Population assigned to metropolitan area "A"}}{\text{Total population in state}} = \frac{\text{Actual population of metropolitan area "A"}}{\text{Total metropolitan population in state}}$$

Use of the formula may be illustrated as follows:

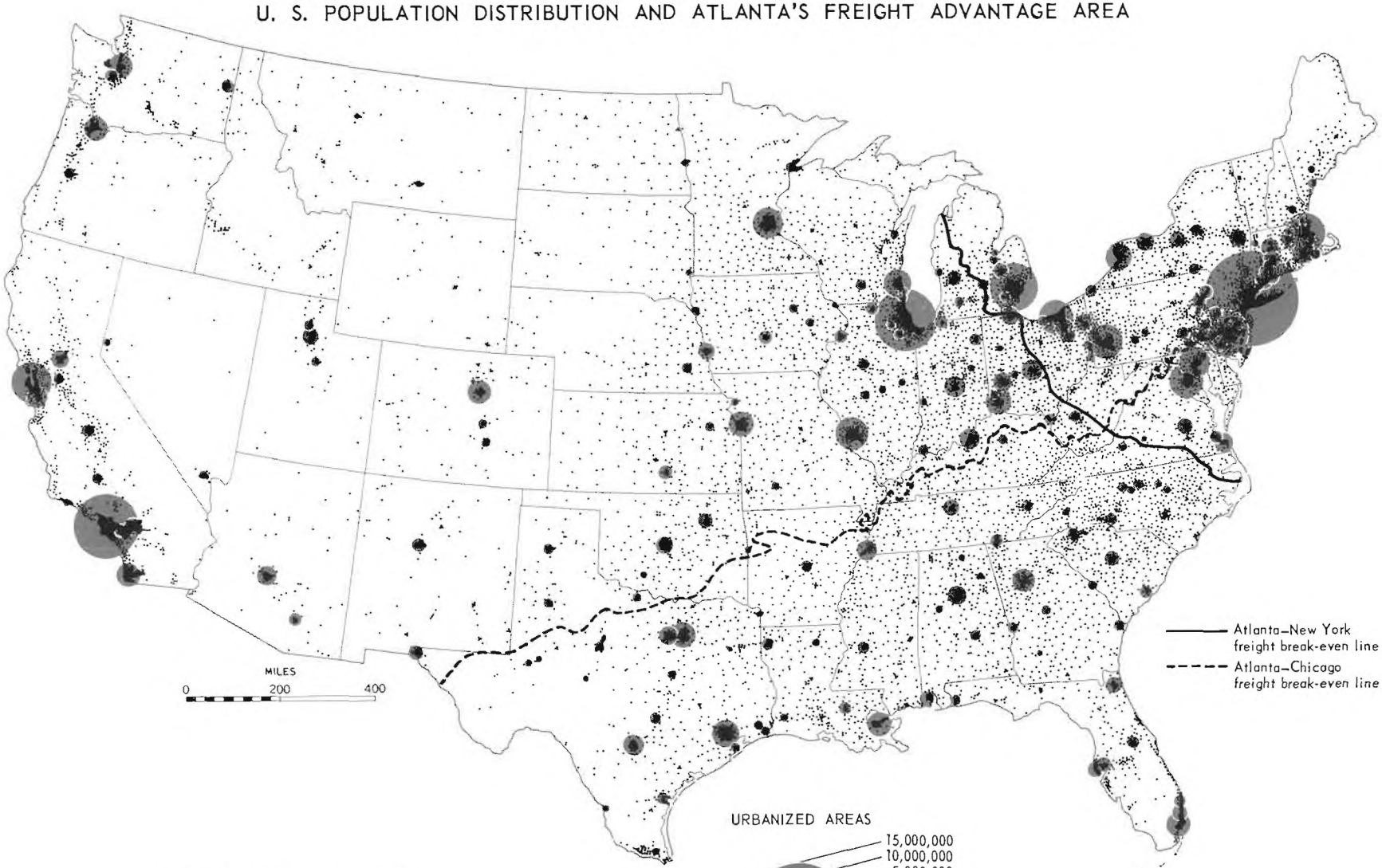
Population assigned to Atlanta	=	X
Total population in Georgia	=	3,943,116
Actual population of Atlanta (1960)	=	1,017,188
Total metropolitan population in Georgia (1960)	=	1,814,069

$$\frac{X}{3,943,116} = \frac{1,017,188}{1,814,069} \text{ or } 56.1\%$$

1/ Throughout this publication, population figures are derived from 1960 Census of Population information.

MAP 1

U. S. POPULATION DISTRIBUTION AND ATLANTA'S FREIGHT ADVANTAGE AREA



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BASE MAP SOURCE: 1960 Census of Population

Then X, the population assigned to Atlanta, equals 2,212,000. The formula excludes those portions of each state's population which fall outside of the freight advantage study area.

Columns (4), (6), and (8) list the Class 100 motor carrier rates on truckload quantities of product shipped from Atlanta, Chicago, and New York to each of the 59 metropolitan areas listed.

Columns (5), (7), and (9) list the freight bills for shipping from each origin to each destination, assuming that each person assigned to each metropolitan area buys one pound of the product being shipped. Column (10) lists the cheaper of the rates from Chicago or New York, and Column (11) lists the cheaper freight bill.

Total cost for shipping 41 million pounds of product in the described manner from each origin or combination of origins is as follows (Table 2):

From Atlanta	$1,192,981
From Chicago	1,790,565
From New York	2,095,574
From Chicago or New York -- optimum shipping arrangements	1,715,323

Atlanta's freight advantage over the optimum combination of Chicago and New York shipments is $522,342, or 30.4% of $1,715,323.

Although the analysis is based on Class 100 motor carrier rates, and a uniform per capita consumption of one pound is assumed, the calculated 30% savings would hold roughly for most products, regardless of shipping class or per capita consumption. A notable group of exceptions are those products with established commodity rates out of either Chicago or New York but not out of Atlanta; in these cases percentage savings would be less than 30%. But since comparable commodity rates may be established out of Atlanta if there is a substantial volume of traffic movement, it is unreasonable in the long run to treat these products as exceptions. With commodity rates established from all three origins, savings on shipping costs from Atlanta as compared with Chicago and New York would approach the 30% projected for commodities in general.

Graph 1 permits a rough estimate of the absolute dollar savings which any company presently shipping consumer products uniformly throughout the eastern United States from Chicago and New York can expect from installation

Table 2

AN ANALYSIS OF FREIGHT BILL SAVINGS

(1) Metropolitan Area	(2) Actual Population (thousands)	(3) Assigned Population (thousands)	Atlanta (4) Rate (¢/cwt.)	Atlanta (5) Freight Bill	Chicago (6) Rate (¢/cwt.)	Chicago (7) Freight Bill	New York (8) Rate (¢/cwt.)	New York (9) Freight Bill	New York or Chicago (10) Lower Rate (¢/cwt.)	New York or Chicago (11) Cheaper Freight Bill
ALABAMA										
Birmingham	635	1,395	180	$25,110	377	$52,592	481	$67,100	377	$52,592
Gadsden	97	212	155	3,286	383	8,120	466	9,879	383	8,120
Huntsville	117	258	204	5,263	349	9,004	466	12,023	349	9,004
Mobile	314	689	251	17,294	439	30,247	544	37,482	439	30,247
Montgomery	169	372	183	6,808	410	15,252	494	18,377	410	15,252
Tuscaloosa	109	238	204	4,855	383	9,115	494	11,757	383	9,115
ARKANSAS										
Little Rock-North Little Rock	243	1,272	359	45,665	380	48,336	554	70,469	380	48,336
FLORIDA										
Fort Lauderdale-Hollywood	334	510	347	17,697	592	30,192	564	28,764	564	28,764
Jacksonville	455	693	244	16,909	502	34,789	473	32,779	473	32,779
Miami	935	1,426	352	50,195	600	85,560	571	81,425	571	81,425
Orlando	318	485	290	14,065	537	26,045	516	25,026	516	25,026
Pensacola	203	312	244	7,613	453	14,134	537	16,754	453	14,134
Tampa-St. Petersburg	772	1,178	301	35,458	550	64,790	529	62,316	529	62,316
West Palm Beach	228	347	333	11,555	578	20,057	550	19,085	550	19,085
GEORGIA										
Albany	76	166	161	2,673	453	7,520	488	8,101	453	7,520
Atlanta	1,017	2,212	-	-	404	89,365	446	98,655	404	89,365
Augusta*	276	549	164	9,007	453	24,870	425	23,333	425	23,333
Columbus*	218	476	140	6,664	431	20,516	481	22,896	431	20,516
Macon	180	390	129	5,031	431	16,809	460	17,940	431	16,809
Savannah	188	410	199	8,159	481	19,721	439	17,999	439	17,999
KENTUCKY										
Lexington	132	1,562	264	41,237	279	43,580	417	65,135	279	43,580
LOUISIANA										
Baton Rouge	230	459	320	14,688	446	20,471	600	27,540	446	20,471
Lake Charles	145	290	418	12,122	489	14,181	621	18,009	489	14,181
Monroe	102	202	353	7,131	431	8,706	574	11,595	431	8,706
New Orleans	868	1,739	296	51,474	453	78,777	578	100,514	453	78,777
Shreveport	281	563	387	21,788	453	25,504	601	33,836	453	25,504
MISSISSIPPI										
Jackson	187	2,178	271	59,024	398	86,684	550	119,790	398	86,684
NORTH CAROLINA										
Asheville	130	533	215	11,460	390	20,787	398	21,213	390	20,787
Charlotte	272	1,107	222	24,575	439	48,597	362	40,073	362	40,073
Durham	112	456	271	12,358	439	20,018	327	14,911	327	14,911

(See notes at end of table.)

Table 2 (continued)

(1) Metropolitan Area	(2) Actual Population (thousands)	(3) Assigned Population (thousands)	Atlanta (4) Rate (¢/cwt.)	Atlanta (5) Freight Bill	Chicago (6) Rate (¢/cwt.)	Chicago (7) Freight Bill	New York (8) Rate (¢/cwt.)	New York (9) Freight Bill	New York or Chicago (10) Lower Rate (¢/cwt.)	New York or Chicago (11) Cheaper Freight Bill
NORTH CAROLINA										
Greensboro-High Point	247	1,002	251	25,150	431	43,186	336	33,667	336	33,667
Raleigh	169	688	271	18,645	446	30,685	327	22,498	327	22,498
Winston-Salem	189	770	251	19,327	425	32,725	336	25,872	336	25,872
SOUTH CAROLINA										
Charleston	216	672	237	15,926	481	32,323	404	27,149	404	27,149
Columbia	261	810	207	16,767	439	35,559	398	32,238	398	32,238
Greenville	210	650	173	11,245	425	27,625	398	25,870	398	25,872
TENNESSEE										
Chattanooga*	283	620	165	10,230	355	22,010	439	27,218	439	22,010
Knoxville	368	803	190	15,257	342	27,463	404	32,441	342	27,463
Memphis	627	1,370	271	37,127	327	44,799	529	72,473	327	44,799
Nashville	400	874	229	20,015	301	26,307	481	42,039	301	26,307
TEXAS										
Abilene	120	192	512	9,830	527	10,118	697	13,382	527	10,118
Austin	212	335	497	16,650	533	17,856	690	23,115	533	17,856
Beaumont-Port Arthur	306	479	431	20,645	505	24,190	635	30,417	505	24,190
Brownsville-Harlingen-San Benito	151	239	564	13,480	622	14,866	757	18,092	622	14,866
Corpus Christi	222	345	527	18,182	586	20,217	717	24,737	586	20,217
Dallas	1,084	1,705	461	78,601	442	75,361	649	110,654	442	75,361
Fort Worth	573	900	461	41,490	442	39,780	649	58,410	442	39,780
Galveston-Texas City	140	220	461	10,142	471	10,362	655	14,410	471	10,362
Houston	1,243	1,964	461	90,540	471	92,504	655	128,642	471	92,504
Laredo	65	105	564	5,922	552	5,796	752	7,896	552	5,796
Midland	68	105	564	5,922	564	5,922	745	7,822	564	5,922
Odessa	100	144	564	8,122	564	8,122	745	10,728	564	8,122
San Angelo	65	105	533	5,597	548	5,754	717	7,529	548	5,754
San Antonio	687	1,083	519	56,208	504	54,583	710	76,893	504	54,583
Texarkana*	92	262	410	10,742	431	11,292	594	15,563	431	11,292
Tyler	86	134	431	5,775	468	6,271	628	8,415	468	6,271
Waco	150	239	468	11,185	512	12,237	662	15,822	512	12,237
VIRGINIA-WEST VIRGINIA										
Roanoke	159	1,555	290	45,095	375	58,313	301	46,806	301	46,806
TOTAL	17,745	41,049		$1,192,981		$1,790,565		$2,095,574		$1,715,323

Notes:

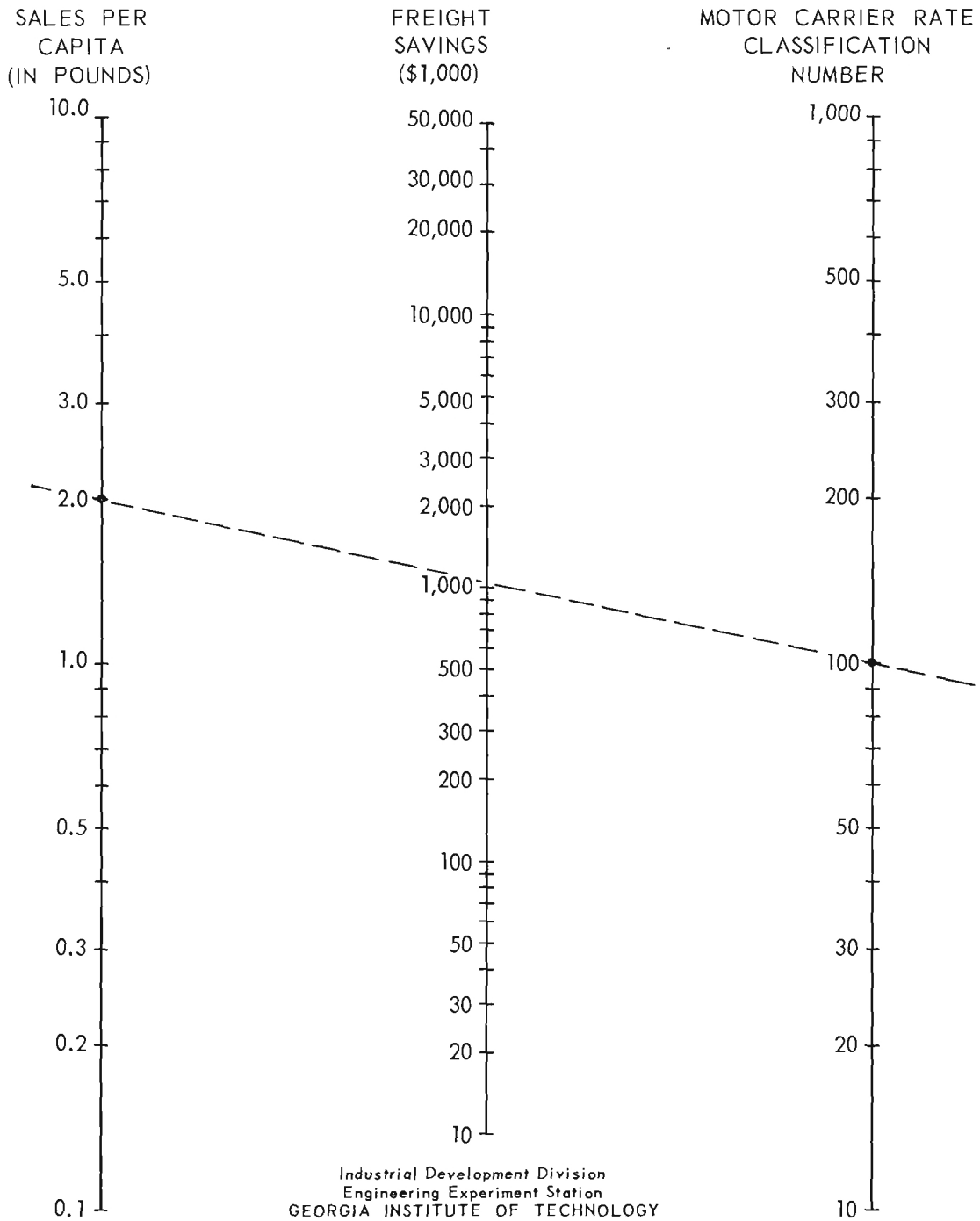
All computations are based on the assumption that rates are Class 100 and per capita consumption is one pound.

Those metropolitan areas marked with an asterisk (*) extend beyond state boundaries.

The total population in the freight advantage area is 42 million. The difference in this total and the assigned population total of 41,049,000 resulted from the method used in assigning population to metropolitan areas.

GRAPH 1

FREIGHT SAVINGS NOMOGRAPH



of a third shipping point in Atlanta. A straight line connecting the company's per capita sales (in pounds) with the established motor carrier rate classification number[1/] for the product will intersect the middle scale at a rough estimate of the potential savings. The example illustrated on the nomograph shows a straight line connecting per capita sales of two pounds with a motor rate classification number of 100; potential savings are roughly $1,050,000.

If Atlanta were under consideration as a location for a second shipping point to serve the East and if the first shipping point were in either Chicago or New York, the possible freight bill saving would be much larger. As indicated earlier, Map 1 shows the freight advantage area which Atlanta would serve if it were competing with Chicago alone (dotted line) or New York alone (solid line).

Atlanta Compared with Other Southern Cities

Atlanta is the South's most strategically located distribution center. Unlike coastal cities, it is in a position to ship in every direction to population centers. Unlike cities farther to the west, its immediate hinterland is dotted with dozens of cities, towns, and villages. Unlike cities located farther to the north, its distribution channels are directed toward southern states rather than midwestern or mid-Atlantic states.

Map 2 shows the area to which each of five southern cities can ship more cheaply than either Chicago or New York. For clarity, the areas are delineated by straight lines which are equidistant from compared cities, rather than by actual equal freight lines. The closeness with which these straight-line freight advantage "envelopes" approximate the actual freight rate advantage areas may be judged by comparing Atlanta's envelope on Map 2 with Atlanta's actual freight advantage area on Map 1.

Because of keen competition among chemical manufacturers, rapid delivery has become a primary selling point. The major operative factor in any distribution system concerned with rapid delivery is the density of population at various distances from the warehouse. The higher the concentration of

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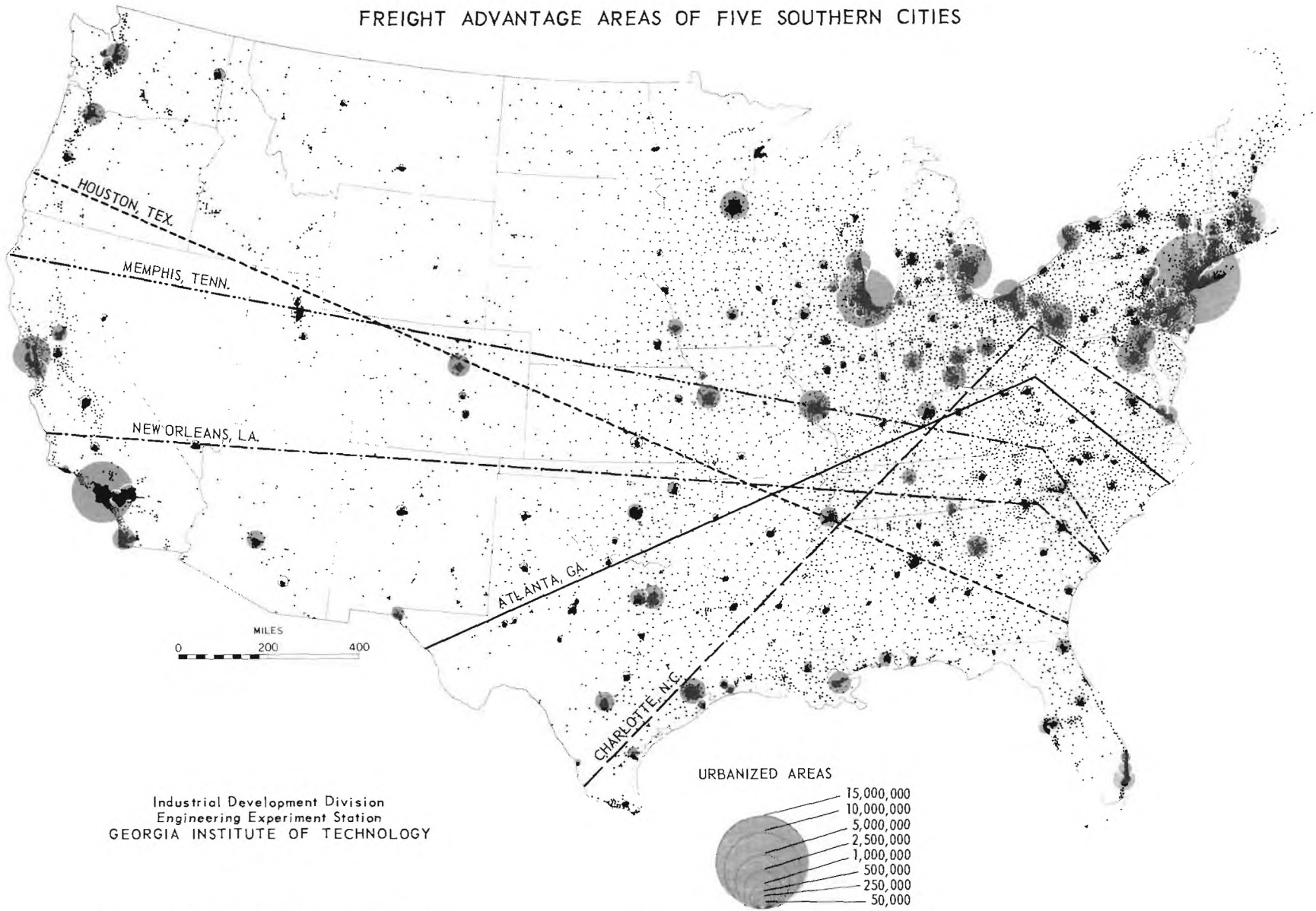
1/ More accuracy can be obtained by expressing the rate classification for the product as a percentage of Class 100 rates.

MAP 2

FREIGHT ADVANTAGE AREAS OF FIVE SOUTHERN CITIES



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BASE MAP SOURCE: 1960 Census of Population

consumers at one, three, and five hundred miles from the warehouse, the greater the number of customers who will receive rapid service.

Population-distance curves can be derived for each of the cities with freight advantage envelopes on Map 2 by constructing a series of concentric circles at measured distances from each city center, counting the population within each circle, and then plotting the population of each circle against its radius in miles. If each city had an established transportation complex comparable with Atlanta's, the most strategic distribution location would be the city which had the greatest number of people at the shortest distance from the city center.

Graph 2 shows the results of such an analysis. Atlanta is the only distribution center which consistently offers efficient access to a large number of people in the southern market, regardless of the distance from the city center.

Of all five cities, Houston has the greatest population within 25 miles of its center, but at greater distances the other four cities are generally more desirable locations for distribution. Charlotte's freight advantage envelope has about 5% more people than Atlanta's at distances of 100 to 250 miles, but 400 miles out it includes about four million less people. The population served by Memphis exceeds that served by Atlanta at distances of 400 miles or greater, but within 400 miles of its city center, Memphis falls far short of Atlanta's population density. New Orleans consistently falls short.

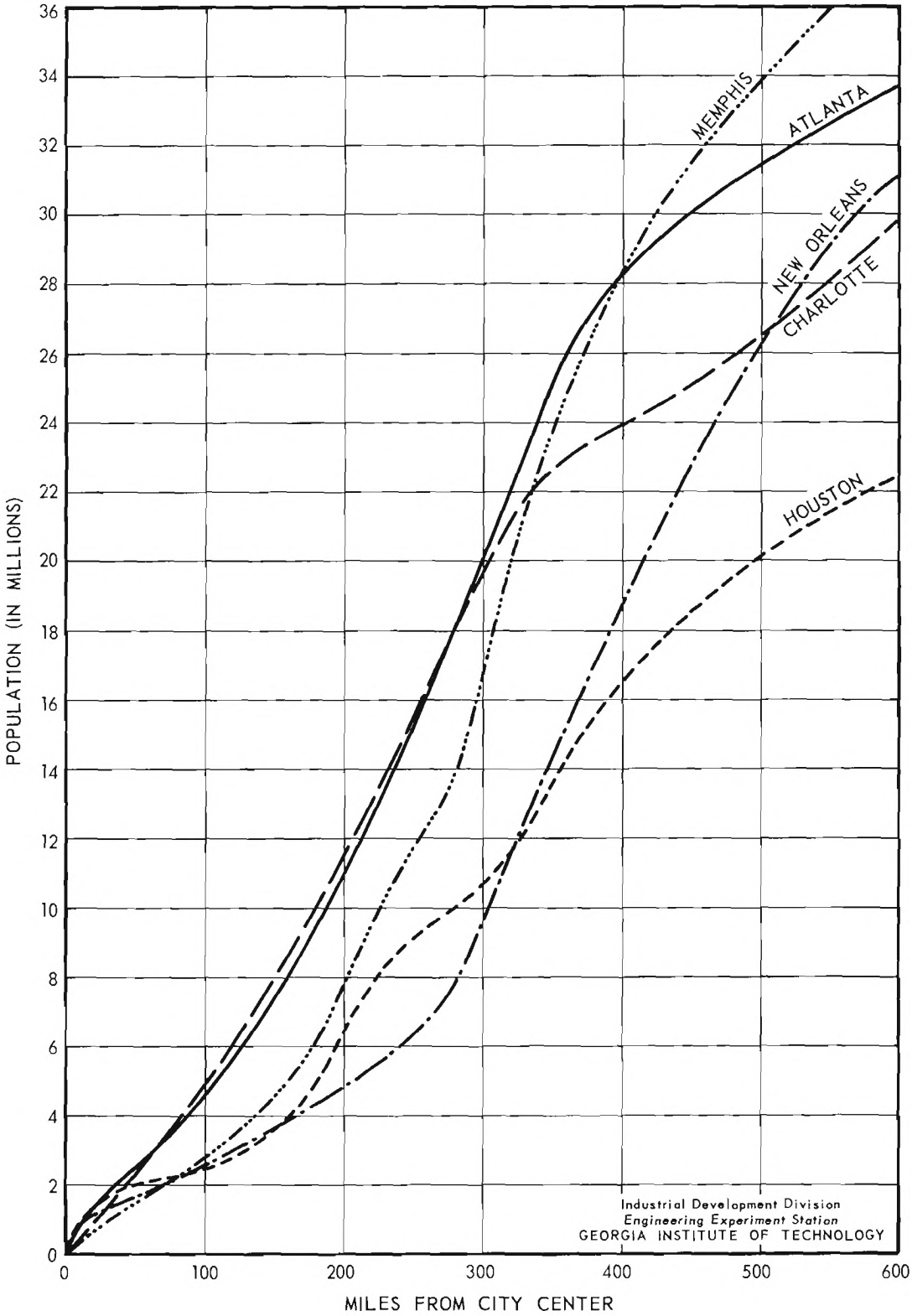
Distribution of Industrial Chemicals from Savannah

According to the 1958 Census of Business, Savannah wholesaled $19,755,000 in drugs, chemicals, and allied products in that year. The 1958 Census of Manufactures shows that chemical companies in the standard metropolitan area added a value of $27,793,000 to their raw materials.

Although these figures are small in comparison with the activity of the large northeastern ports, Savannah has only recently begun to expand to serve the growing needs of industries in the southeast. Both the textile industry and the pulp and paper industry are large and expanding, and can be served more

GRAPH 2

POPULATION CONCENTRATION VERSUS DISTANCE FROM
FIVE SOUTHERN CITIES



economically from Savannah than from New Orleans, New York, or a combination of the two ports.

The following sections present information on (1) the size of the textile and pulp and paper industries which can be served more cheaply from Savannah than from New Orleans and New York, and (2) the comparative advantages of serving the southeastern textile industry from Charleston, South Carolina; Jacksonville, Florida; Savannah, Georgia; and Wilmington, North Carolina.

Savannah Compared with New Orleans and New York

Savings in shipping costs which would accrue from the establishment of a shipping point in Savannah for the distribution of industrial chemicals have not been evaluated, largely because companies in this field seldom agree on the best combination of shipping points for serving a given area. Consequently, New Orleans and New York, or any other combination of ports which might have been selected, will represent the present circumstances of only a few companies and for only a small part of their product lines. In many cases, companies will have established several shipping points, both inland and deep-water, for distribution of their industrial chemicals.

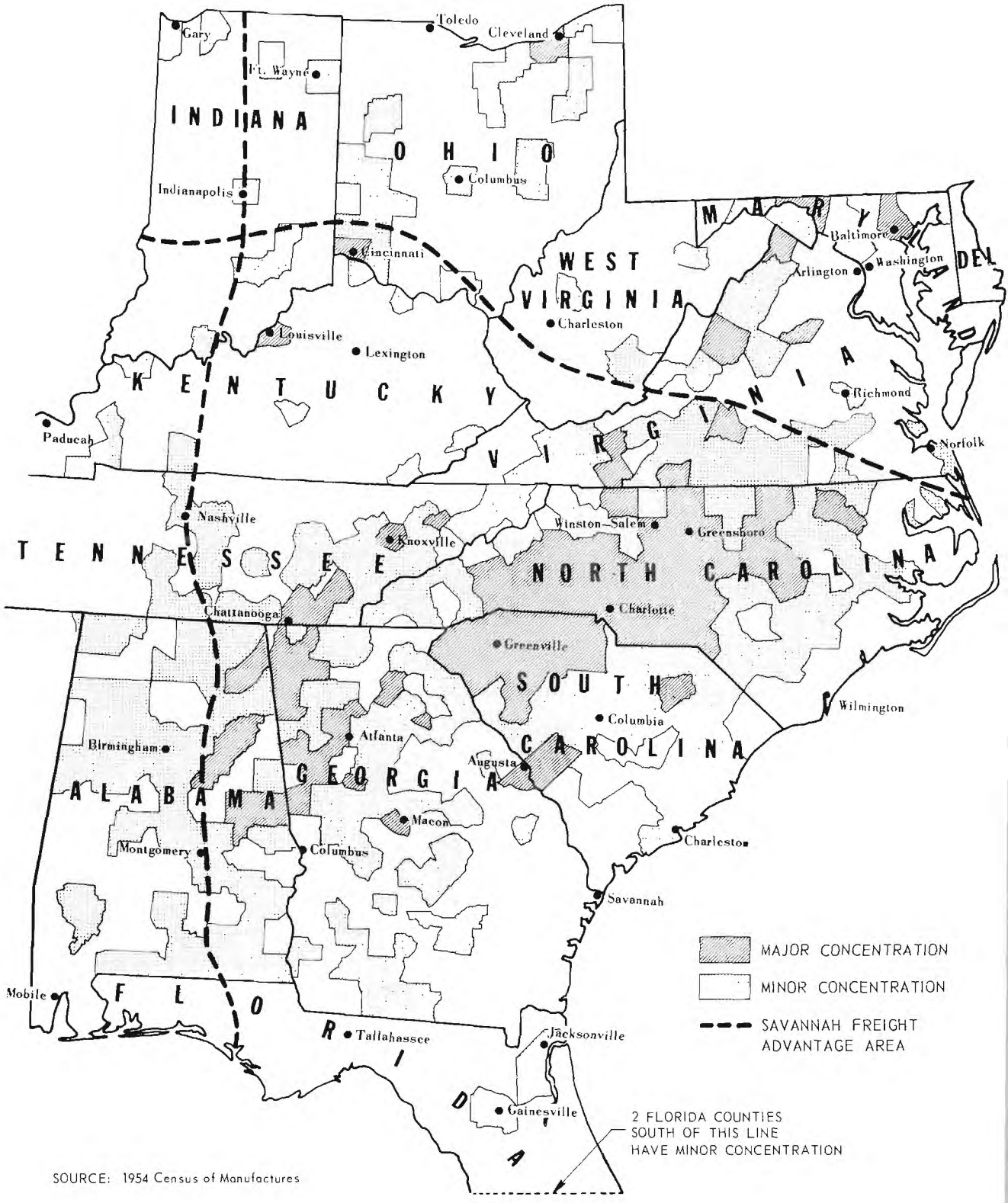
New Orleans and New York were used in determining Savannah's freight advantage area simply because they are the largest ports on their respective coast lines. If more southern ports, such as Wilmington, Delaware, or Baltimore, were used instead of New York, or a more eastern port, such as Mobile, were used instead of New Orleans, the same point could be made: because the textile industry and the pulp and paper industry are concentrated in the Southeast, Savannah is a desirable port from which to serve their industrial chemical needs.

Map 3 shows the concentration of the textile industry in 12 states and delineates the area in which Savannah has a freight advantage over New Orleans and New York. The area east of the vertical heavy dotted line can be served at least as cheaply from Savannah as from New Orleans. The area south of the horizontal heavy dotted line can be served at least as cheaply from Savannah as from New York. Motor Class 100 truckload rates were used in establishing both equal freight lines.

Within the area best served from Savannah, 2,059 textile mills (SIC 22) produced more than 52% of the total value added by manufacture by the textile

MAP 3

TEXTILE INDUSTRY CONCENTRATION IN TWELVE STATES



SOURCE: 1954 Census of Manufactures

industry in the United States in 1958, according to the Census of Manufactures for that year. Nearly 1,600 of these plants are within 300 miles of Savannah; they produce 40% of the total value added by all textile mills in the United States.

Map 4 shows the location of pulp and paper mills in seven southeastern states and the area in which Savannah has a freight advantage over New Orleans and New York. The capacity of each mill is indicated by the area of the circle representing the mill location.

Wood pulp output and paper and board output for each of the seven states and for the United States are shown in Table 3. The seven-state area produced 43% of national pulp output, primarily by the kraft process. It also produced 30% of the national output of paper and board; paperboard accounted for the largest part of the area's output. Georgia contributed about one-quarter of the area's output in both categories.

Table 3

PRODUCTION OF WOOD PULP AND PAPER AND BOARD
IN SEVEN SOUTHEASTERN STATES, 1962

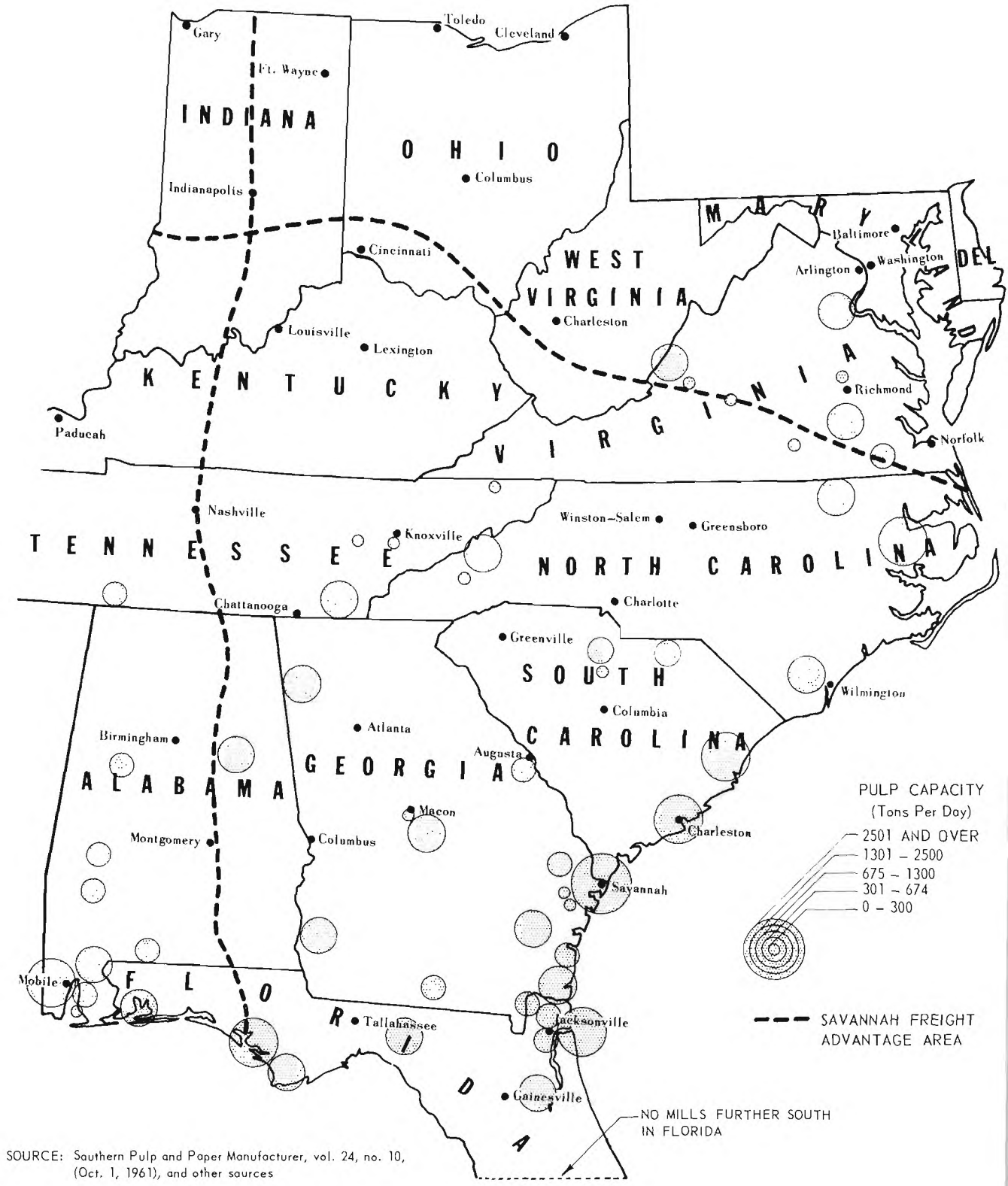
(in short tons)

	Wood Pulp	Paper and Board
Alabama	1,529,660	1,536,424
Florida	2,569,109	2,102,012
GEORGIA	3,031,562	2,576,898
North Carolina	1,402,162	1,242,012
South Carolina	1,280,000	1,244,250
Tennessee	849,596	1,016,939
Virginia	1,299,514	1,429,993
Seven-state Total	11,961,604	11,148,528
U. S. Total	27,908,330	37,648,273

Source: U. S. Department of Commerce, Pulp, Paper and Board, 1962, with the exception of the wood pulp total for South Carolina, which was estimated by the Industrial Development Division.

MAP 4

PULP AND PAPER MILLS IN SEVEN SOUTHEASTERN STATES



SOURCE: Southern Pulp and Paper Manufacturer, vol. 24, no. 10, (Oct. 1, 1961), and other saurces

Savannah Compared with Other Southeastern Deepwater Ports

Savannah, Brunswick, and St. Marys-Kings Bay, Georgia, and Jacksonville, Florida, are the westernmost deepwater ports on the East Coast. Savannah lies west of New York and Pennsylvania; most of the states of West Virginia, Virginia, and the Carolinas lie to the east of Savannah.

Among the deepwater ports in other states which can compete with Savannah as distribution centers to the southeastern industrial chemical market are Wilmington, North Carolina; Charleston, South Carolina; and Jacksonville, Florida. Reference to Map 4 shows that Savannah is better suited than its three out-of-state competitors for serving the southeastern pulp and paper industry. Savannah, however, is not the obvious best choice for serving the southeastern textile industry. (See Map 3.)

Map 5 shows the geographical area to which each of the four southeastern ports can ship more cheaply than either New Orleans or New York. Also shown is the textile industry concentration in 12 states. Textile industry concentration versus distance curves for each of the four ports are shown in Graph 3. The curves were derived by constructing a series of concentric circles about each city at measured distances from the city centers, counting the number of textile mills in each circle,[1/] estimating the value added by manufacture by the mills operating in each circle,[2/] and then plotting the value added by mills operating in each circle (in millions of dollars) against the radius of the circle (in miles).

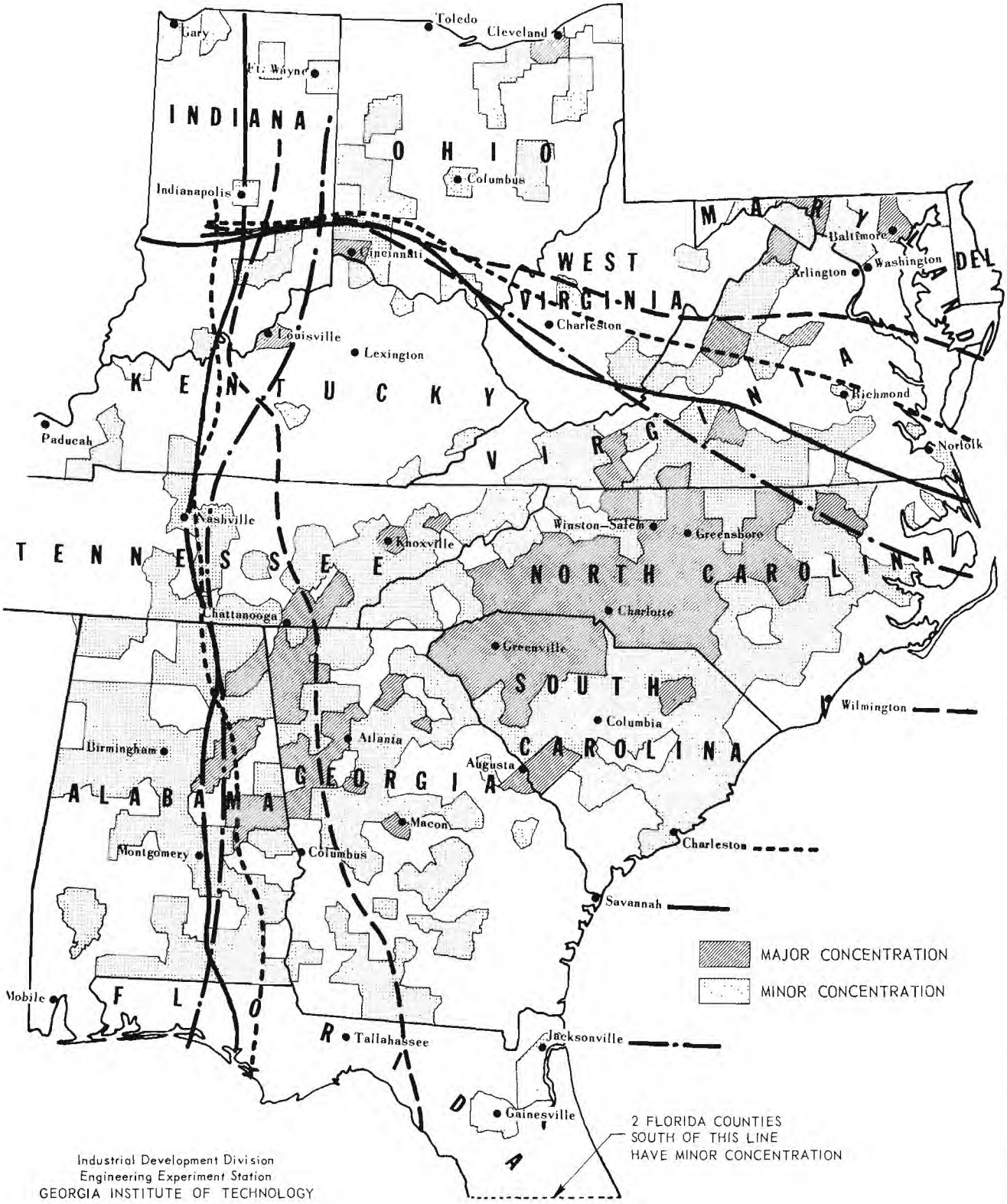
Graph 3 and the data used in constructing the figure presented in Table 4 show that Wilmington, North Carolina, has a larger volume of textile manufacturing within 150 miles of its center than the other three ports. At 200

1/ Because this step required knowing how many textile mills were operating in each county of the 12 states, it was necessary to begin with statistics published in the 1956 County and City Data Book, which were based on the 1954 Census of Manufactures. This source identified the county locations of all textile mills with 20 or more employees in 1954. These data were expanded to include plants with less than 20 employees and updated to 1958 by use of ratios derived from the 1954 and 1958 Censuses of Manufactures.

2/ To perform this step it was necessary to assume that each textile mill within a state was of the same size and produced the same value added. For example, the 338 textile mills in Georgia in 1958 produced a total value added of $442,812,000, according to the Census of Manufactures. It was assumed that each mill in each county produced a value added of $1,310,095.

MAP 5

FREIGHT ADVANTAGE AREAS OF FOUR SOUTHEASTERN PORTS



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GRAPH 3

TEXTILE MANUFACTURING ACTIVITY VERSUS DISTANCE FROM FOUR SOUTHEASTERN PORTS

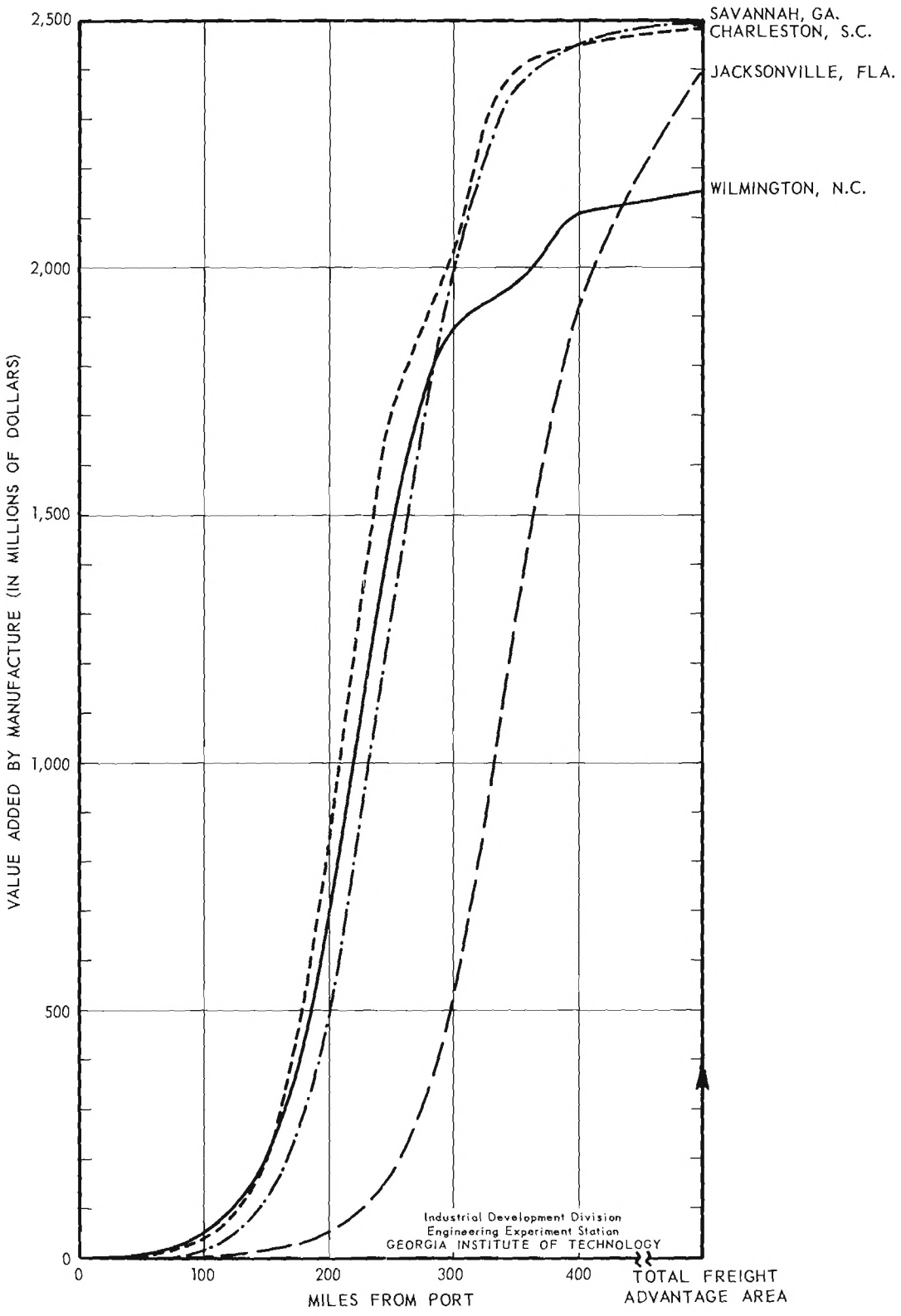


Table 4

TEXTILE MANUFACTURING ACTIVITY WITHIN SELECTED DISTANCES FROM FOUR SOUTHEASTERN PORTS[1/]

Miles From Port	Value Added by Textile Manufacturers (in millions of dollars)			
	Charleston	Jacksonville	Savannah	Wilmington
50	5	2	0	1
100	30	5	9	56
150	197	18	115	204
200	827	43	485	738
250	1,689	170	1,272	1,476
300	2,000	532	2,000	1,877
350	2,408	1,259	2,363	1,959
400	2,460	1,928	2,459	2,112
Total Freight Advantage Area	2,483	2,393	2,488	2,150

1/ Includes only textile manufacturers within each port's freight advantage area. (See Map 5.)

and 250 miles out, Charleston has the greatest volume of textile manufacturing. At 300, 350, and 400 miles, Savannah and Charleston have about equal volumes. Savannah has the largest total volume of textile manufacturing within its freight advantage area. At distances of 400 miles or less from its center, Jacksonville consistently falls short of the other three ports; it has a larger total volume of textile manufacturing within its freight advantage area than Wilmington, North Carolina, however.

Savannah is not as clearly the best choice for distribution to the textile industry as it is for distribution to the pulp and paper industry or as Atlanta is for distribution to the southeastern consumer market. Perhaps the best bases for distinguishing Savannah from its strongest competitor, Charleston, are the quality, economy, and efficiency of the port, rail and trucking facilities, and the desirability of the living conditions offered by each city.

Chemical Distributors in Georgia

Some of the manufacturers and wholesalers which currently operate distribution points in Georgia are listed in Table 5. In many cases the larger manufacturers maintain separate sales offices for each of their major divisions, but do not warehouse or manufacture in Georgia all of the chemicals

produced by each division. Usually the bulk products which are not warehoused by manufacturers are available from wholesalers in smaller-than-bulk-rate quantities.

Table 5

SOME CHEMICAL DISTRIBUTORS IN GEORGIA

Air Reduction Co., Inc.
Allied Chemical Corp.
American Agricultural Chemical Co.
American Cryogenics Inc.
American Cyanamid Co.
American Potash and Chemical Corp.
The Arabol Manufacturing Co.
Archer-Daniels-Midland Co.
Armour Industrial Chemical Co.
Atlas Powder Co.
California Chemical Co.
Celanese Corp. of America
Chemetron Corp.
Commercial Solvents Corp.
Crown Chemical Corp.
Detrex Chemical Industries
Diamond Crystal Salt Co.
Distillation Products Industries
The Diversey Corp.
Dodge and Olcott, Inc.
Dow Chemical Co.
Dow Corning Corp.
E. I. du Pont de Nemours & Co., Inc.
Eastman Chemical Products, Inc.
Escambia Chemical Corp.
FMC Corp.
First Texas Pharmaceuticals, Inc.
Glidden Co.
B. F. Goodrich Chemical Co.
Goodyear Tire and Rubber Co.
Great Lakes Carbon Corp.
Hercules Powder Co., Inc.
Heyden Newport Chemical Corp.
Philip A. Hunt Co.
Industrial Chemical & Supply Co., Inc.
International Latex Corp.
International Minerals and Chemical Corp.
Kohnstamm & Co., Inc.
Koppers Co., Inc.
Fredrick H. Levey Co., Inc.
Magnus Chemical Co., Inc.
McKesson & Robbins, Inc.
Merck & Co., Inc.
Metal & Thermit Corp.
Minnesota Mining and Manufacturing Co.
Monsanto Chemical Co.
Morningstar-Paisley, Inc.
Morton Chemical Co.
Morton Salt Co.
National Lead Co.
National Starch & Chemical Corp.
NOPCO Chemical Co.
Olin Mathieson Chemical Corp.
Pennsalt Chemicals Corp.
Pennsylvania Industrial Chemical Corp.
Pfister Chemical Works, Inc.
Charles Pfizer & Co., Inc.
Pittsburgh Plate Glass Co.
Potash Co. of America
Puritan Chemical Co.
Reichhold Chemicals, Inc.
Rohm and Haas Co.
F. H. Ross & Co.
Shell Chemical Co.
Shell Oil Co.
Southern Nitrogen Co., Inc.
Southern Resin and Fiberglass Corp.
Southern States Chemical Corp.
Spencer Chemical Co.
Stauffer Chemical Co.
Stein Hall & Co., Inc.
Stepan Chemical Co.
Swift & Co.
Tennessee Corp.
Texas Gulf Sulphur Co.
Titanium Pigment Corp.
Union Carbide Corp.
U. S. Industrial Chemicals Co.
Whitaker Oil Co.
Witco Chemical Co.
Wyandotte Chemicals Corp.

Part II

GEORGIA'S RESOURCES FOR THE CHEMICAL INDUSTRY

GEORGIA'S TRANSPORTATION RESOURCES

Water Transportation

Brunswick, St. Marys-Kings Bay, and Savannah -- Georgia's three deepwater ports -- are among the westernmost U. S. cities on the Atlantic Coast and have the most direct approach to the mid-continental U. S. of any cities on the Eastern Seaboard. These three ports and the inland port of Augusta on the Savannah River have access by barge to cities on the Eastern Seaboard via the Atlantic section of the Intracoastal Waterway. The inland ports of Columbus, on the Chattahoochee River, and Bainbridge, on the Flint River, connect via the Gulf section of the Intracoastal Waterway to the mid-continental inland waterway systems. All six cities are shown on Map 6, together with the number of miles between important shipping centers.

Much of the development of Georgia's ports has come in recent years. The Georgia Ports Authority operated 18 deepwater berths at the end of 1962, compared with only five in 1956. It will have 21 berths by the middle of 1963, when construction will be completed on an $11.5 million bond issue. All three inland ports have been developed since 1957.

Because of its interest in port and industry development, the State has cooperated with industry in constructing handling facilities and warehouse space for specific uses. The bulk cargo terminal and handling facilities at Brunswick were originally built to accommodate Bestwall Gypsum Company. The Georgia Ports Authority has built and leased a pad for outdoor storage of benzene hexachloride for Columbia-Southern Chemical Corporation; a molten sulfur handling and storage facility with a capacity of 10,000 long tons, or 1.5 million gallons, for American Cyanamid Company; asphalt and cutback mixing facilities; and facilities for handling fats and oils. A 5-million-gallon tank farm has been erected by Shell Oil Corporation on Ports Authority property.

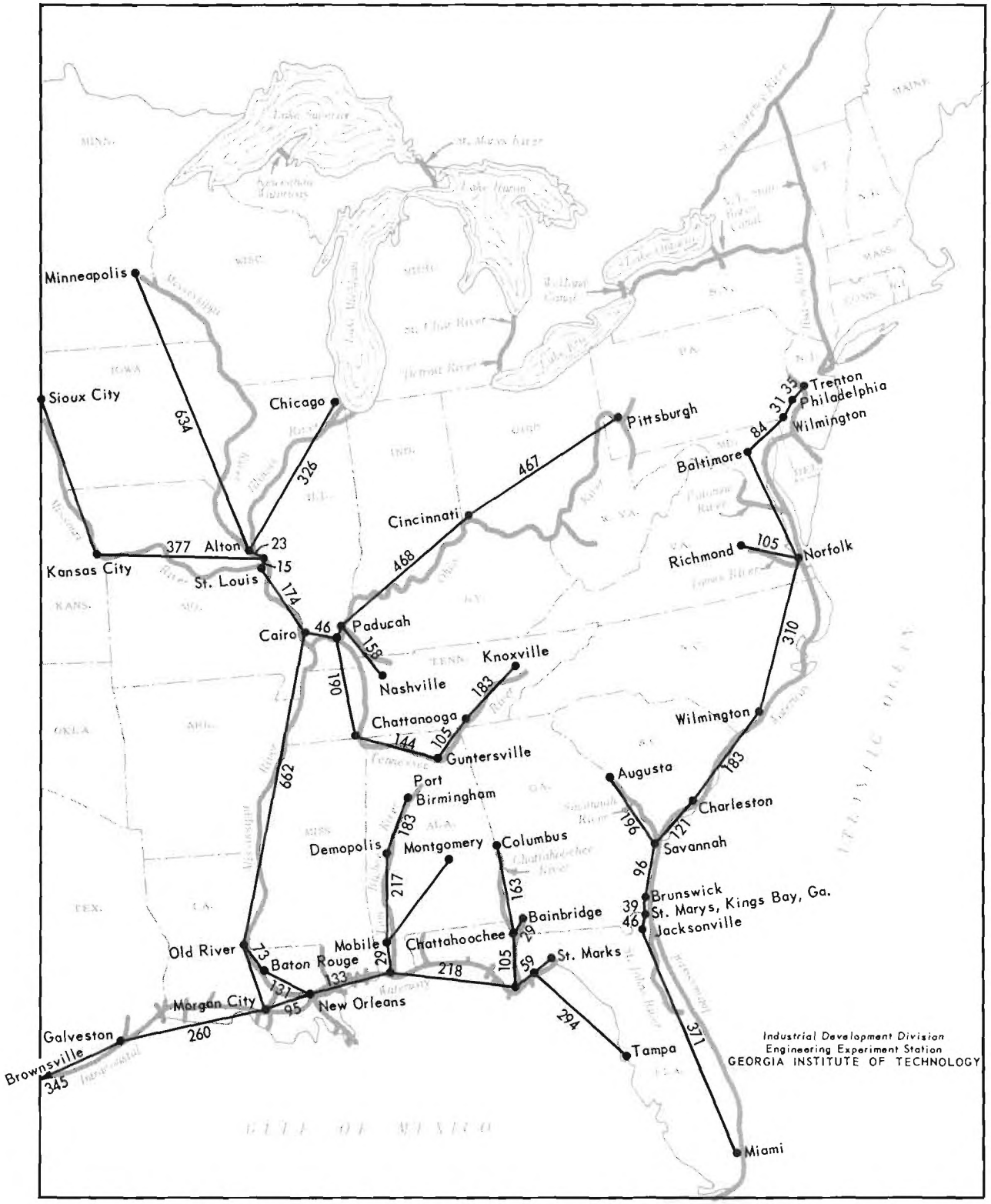
The following sections present details on all six ports. Additional information may be obtained from the Georgia Ports Authority, Post Office Box 1039, Savannah, Georgia.

Deepwater Ports

Savannah. The Port of Savannah is by far the most active deepwater port in the state. In 1960 the harbormaster reported 1,524 vessel entries (777 of

MAP 6

WATERWAYS OF THE EASTERN UNITED STATES



which were American flag ships) totaling 5,676,636 net register tons. Some 53 active deepwater berths are operated by private and state interests.

Harbor dimensions, the four public deepwater terminal facilities, and other Port of Savannah landmarks are shown on Map 7. Atlantic Coast Line Railroad Company facilities include four marginal berths backed up with 128,000 square feet of open space and three sheds totaling 93,000 square feet. Stevens Shipping Company facilities include five shed berths with 268,000 square feet of storage space, one open berth with 46,000 square feet of space, a dehumidifier for bulk solids, conveyors, and a liquid storage facility.

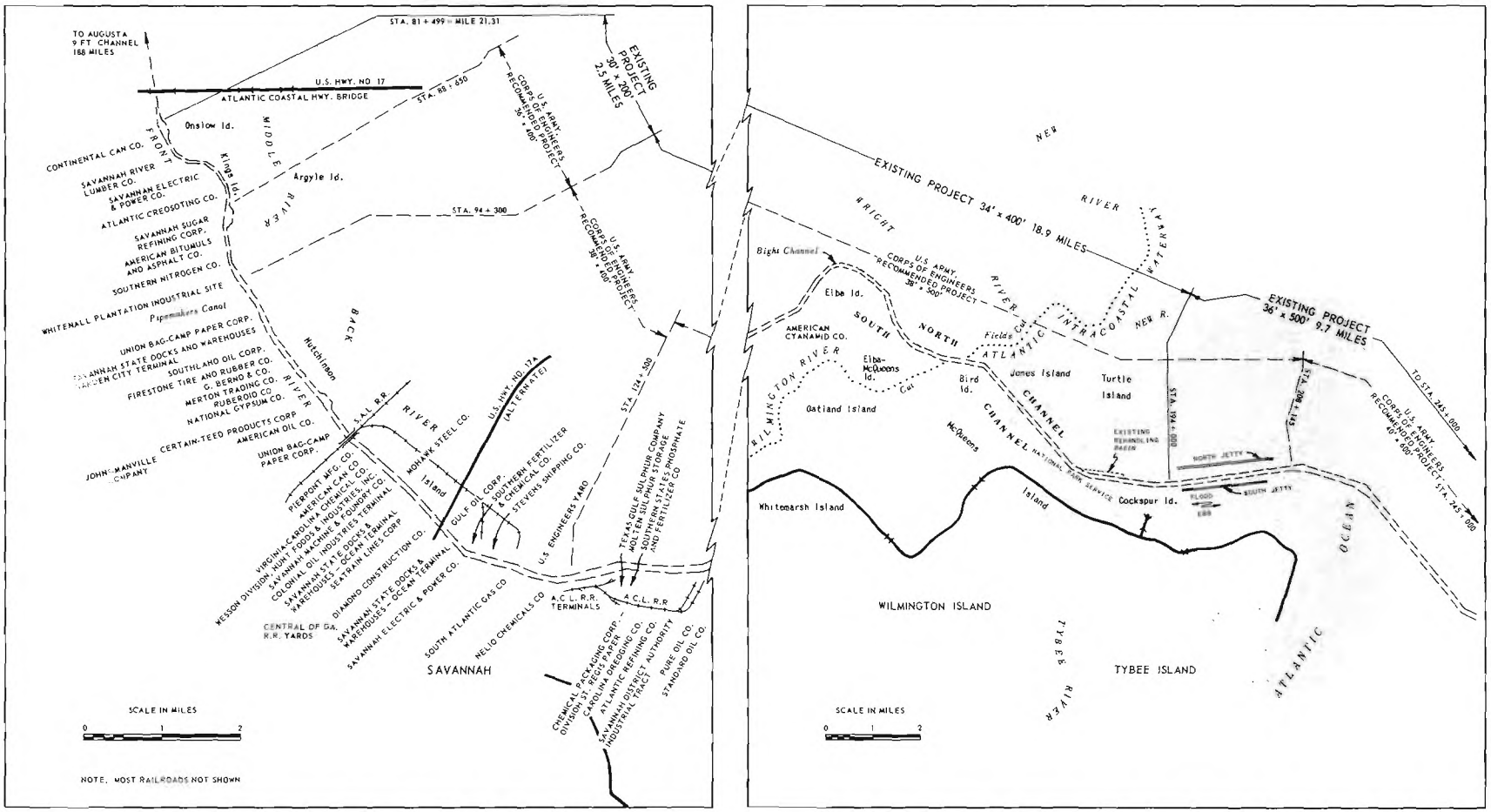
Georgia Ports Authority facilities include Ocean Terminal and Garden City Terminal, as well as two T-head piers with liquid handling and tank storage equipment for petroleum products, petrochemicals, liquid asphalt, molten sulfur, latex, and edible and inedible oils.

Ocean Terminal has four general cargo berths totaling 3,759 lineal feet, one barge berth, two bulk-handling berths with 107,540 square feet of warehouse area for the storage of bulk fertilizers, one berth leased to Seatrain Lines, Inc., for loading and unloading rail cars, four transit sheds totaling 376,000 square feet, and 296,000 square feet of commercial warehouse area. Handling equipment includes four 45-ton mobile cranes as well as the usual fork lifts, tractors, and trailers. Under construction are three general cargo berths, one transit shed of 115,000 square feet, and two heavy duty 45-ton gantry cranes.

Garden City Terminal has seven general cargo berths, totaling 4,515 lineal feet. They are accompanied by five fireproof transit sheds (totaling 327,000 square feet) and open concrete areas for handling heavy equipment. Margins at shipside are 57 feet wide, with double marginal tracks and four diesel-electric 35-ton gantry cranes capable of operating in pairs with a combined lift of 70 tons. Eighteen-foot-wide canopy-covered platforms at the rear of the transit sheds permit access to rail cars at car-floor levels. Truck loading platforms are capable of serving up to 40 vehicles at one time. The area is lighted for night loading.

Adjacent to the transit sheds is more than two million square feet of concrete-floored warehouse space which may be leased on a square-foot basis for storage, processing, or light manufacturing. Some of this area is

MAP 7
PORT FACILITIES AT SAVANNAH, GEORGIA



operated as a commercial warehouse where commodities may be stored on a per-ton basis. The entire area is equipped with modern theft and fire protection systems. Handling equipment includes mobile cranes with lifts of up to 25 tons, fork lifts, and payloaders.

The Garden City Terminal also has export packing service, extensive open storage, a vacuum-type fumigating plant, and a cotton compress. Savannah State Docks Railroad Company is certificated by the Interstate Commerce Commission for the operation of two switch engines (110-ton and 70-ton diesel-electric) on approximately 15 miles of assembly yard and spur trackage on Ports Authority property. There is no charge for switching.

The Port of Savannah is served by 95 steamship lines through six agencies; 38 offer regular service. Seatrain Lines, Inc., provides weekly coastwise service to New York. Additional transportation services are provided by four barge lines, five railroads, three air lines, and 49 motor carriers (including 28 with terminals).

Dockage fee at three of Savannah's public terminals is 3.5 cents per gross registered ton of vessel. Customs officials state that prompt customs service saves from 24 to 48 hours over other eastern ports. Twelve foreign countries have consuls or consular agents in Savannah. Other port services include foreign freight forwarders, custom house brokers, pilots, ship chandleries, radio service, bunker facilities, and towing equipment.

Brunswick. The Port of Brunswick has two public deepwater berths beside its turning basin, which is 1,000 feet long and 700 feet wide with a project depth of 30 feet mean low water (MLW). The harbor is reached by a 13-mile channel from the Atlantic Ocean. With a project depth of 30 feet MLW, the channel narrows from 500 feet at the ocean to 300 feet at the turning basin.

The Georgia Ports Authority operates one deepwater berth at Brunswick. The 560-foot berth and its 57,000-square-foot transit shed were built in 1959. The facility is equipped with modern theft and fire protection systems and cargo-handling machinery. Yard facilities include double rail tracks on the 52-foot dock margin and at the rear level platform of the transit shed, and truck loading and unloading facilities at the rear and at each end of the transit shed. Under construction are high quality facilities which essentially will duplicate those presently in operation.

The Brunswick Port Authority also operates one deepwater berth. This facility, built in 1958, is 500 feet long and is equipped with a gantry-type grab bucket unloader, conveyors, and marginal tracks for handling bulk cargoes at rates of up to 600 tons per hour. The dock adjoins the one presently operated by the Georgia Ports Authority, so that 1,060 feet of continuous concrete wharfage are available at the turning basin.

Private terminal operators at Brunswick include Allied Chemical Corporation, Brunswick Pulp and Paper Company, and Olin Mathieson Chemical Corporation. The Babcock and Wilcox Company, Hercules Powder Company, and Dixie Paint and Varnish Company, Inc., are among the companies which operate plants with waterfront locations but which ship through public terminals.

Port charges are generally lower than at northeastern ports. Protected anchorage in 10 fathoms with ample swinging room is available, and pilotage, towage, and supplies are efficiently provided. The port is served by the Southern Railway System, the Atlantic Coast Line Railroad, and by some 20 motor carriers.

St. Marys-Kings Bay. Georgia's third deepwater port, Kings Bay Terminal, is located about five miles north of St. Marys and 30 miles south of Brunswick. The multimillion dollar facility was built in the late 1950's for the Department of the Army. Under the provisions of Title 10, U.S.C., Section 2667, all or part of the terminal may be leased, but must be available for use by the Department of the Army if needed in any emergency or mobilization. Part of the terminal presently is being leased by Blue Star Shipping Corporation.

The reinforced concrete wharf, 2,000 feet long by 87 feet wide, is located approximately 10 miles from the Atlantic on a channel 200 feet wide and 32 feet deep, with turning basins. The wharf has service buildings, a control tower, lights, water, fire protection, and rail and truck-handling facilities.

Other structures include an administration building, fire station, cafeteria, material-handling equipment and storage buildings, utility shop and tool houses, a passenger train station, gasoline station, a telephone and intercommunication system, sewage system, wells, fuel storage, and a fueling system. There are approximately 45 miles of railroad trackage, including

classification yard and storage tracks. Some 5,755 acres of the reservation are located within a chain link security fence.

The installation is readily accessible to Georgia Highway 40 and U. S. Highways 17, 1, and 301. It is served by the Seaboard Air Line Railroad and St. Marys Railroad. The St. Marys Air Field is located one mile from the south boundary of the terminal and has four runways 5,000 feet long.

Additional information and lease proposal forms may be secured from the District Engineer, U. S. Army Engineers District, Savannah, Post Office Box 889, Savannah, Georgia.

Barge Ports and Inland Waterways

Georgia's inland barge ports are at Augusta, Bainbridge, and Columbus. The ocean ports of Brunswick and Savannah also have barge facilities.

The Augusta State Docks include one barge berth totaling 200 lineal feet, one transit shed of 42,500 square feet, marginal tracks, and equipment for handling liquid or solid bulk commodities and general cargo. The channel, with a controlling project depth of nine feet and width of 90 feet, runs some 188 miles to the Port of Savannah, from which the Atlantic section of the Intracoastal Waterway may be reached. The new Clark Hill Reservoir assures minimum flow requirements for the channel. The single lock on the Savannah River (New Savannah Bluff Lock and Dam) has inside dimensions of 56 feet by 360 feet and a lift of 15 feet. It will accommodate one standard barge or four "Warrior" barges at one time.

The inland port of Bainbridge has two barge berths totaling 400 lineal feet, one transit shed of 14,000 square feet, one commercial warehouse of 26,000 square feet, marginal tracks, and modern cargo-handling equipment. Private concerns presently using Bainbridge facilities include American Bitumuls and Asphalt Company, Propane Corporation, Georgia Gulf Sulphur Corporation, and Seminole Shell Company. The channel, with a controlling project depth of nine feet and width of 100 feet, runs down the Flint River and the Apalachicola River to the Gulf section of the Intracoastal Waterway. Barges using this 131-mile channel encounter one lock, the Jim Woodruff Lock and Dam on the Apalachicola River. Its inside dimensions are 82 feet by 450 feet, with a lift of 33 feet. It will accommodate four standard barges or nine "Warrior" barges per lockage.

The Georgia State Docks terminal at Columbus was completed in the spring of 1963. The 88-acre site has two barge berths totaling 400 lineal feet, one transit shed of 30,000 square feet, rail and truck facilities, and modern handling equipment for bulk and general cargo. The channel, which has a controlling project depth of nine feet and a width of 100 feet, extends 263 miles down the Chattahoochee River to the Gulf section of the Intracoastal Waterway. Each of the three locks on the channel (at the Walter F. George, Columbia, and Jim Woodruff dams) measures 82 feet by 450 feet. Lifts are 88 feet at Walter F. George Dam and 25 feet at Columbia. The lock at Jim Woodruff Dam is described as part of the Flint-Apalachicola channel in the preceding paragraph.

Because of the newness of Georgia's inland ports and waterways, traffic volumes are relatively light. State docks at Augusta were dedicated in 1962; traffic thus far includes brick shipments to Savannah and petroleum product receipts from Savannah and other coastal cities. The five-year-old Bainbridge facility receives traffic originating in Texas (sulfur, petroleum products); the Midwest (flour and grain); Louisiana (petroleum products, insecticides, oyster shells); and Mobile (shells). Annual cargo tonnages are about 400,000 tons on the entire Apalachicola-Chattahoochee-Flint system.

Barge shipments at the deepwater port of Brunswick totaled about 130,000 tons in 1960. The major commodities shipped out were wood pulp (primarily to New Jersey) and caustic soda. Of barge receipts totaling over 115,000 tons in 1960, residual fuel oil was by far the leading commodity.

Leading commodities barged into Savannah include nitrogenous fertilizer materials and brick. The leading commodities shipped out by barge include gasoline, other petroleum products, paper and paper products, and sugar.

Three certificated barge common carriers serving Georgia ports and their scopes of operation are shown in Table 6. Contract carrier and exempt barge lines also operate irregularly, depending on when they obtain cargoes.

Transit times and rates may be secured from any carrier. Approximate figures are indicated by the following example:[1/] A 600-horsepower tug and

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1/ These estimates were made by a barge line now operating from the Texas Gulf Coast to the Georgia rivers.

a 430,000-gallon barge can deliver isoprene to Columbus, Georgia, from Beaumont, Texas, for 1.3 cents a gallon. Materials requiring higher pressure barges, such as butadiene or propylene, would cost up to 1.7 cents a gallon. A round trip would require about 15 days, allowing 12 hours for each loading and unloading.

Miles between selected shipping centers on the inland waterway systems of the eastern United States are shown on Map 6.

Table 6

SOME CERTIFICATED BARGE CARRIERS SERVING GEORGIA PORTS

Name of Carrier	Points or Localities and Waterways between which or on which Operated
River Transit Company Columbus, Ga.	Warrior-Tombigbee River System (Alabama); and Apalachicola-Chattahoochee-Flint River System (Georgia and Florida).
C. G. Willis, Inc. 705 Mantua Avenue Paulsboro, N. J.	Philadelphia, Pa., Delair and Paulsboro, N. J., and Baltimore, Md., southbound to Brunswick, Ga., and Jacksonville and Fernandina, Fla.; and Brunswick and Savannah, Ga., northbound to Chester, Pa., and Paulsboro, N. J.
S. C. Loveland Co., Inc. 151 S. Front Street Philadelphia 6, Pa.	Atlantic Coast and entire Atlantic Intracoastal Waterway and tributaries from Eastport, Maine, to Key West, Florida.

Rail Transportation

Plateaus extending from Georgia to the Midwest and from Georgia up the Eastern Seaboard make possible low cost railroad operations to a large part of the nation. Terminals within the state are particularly well situated for serving the Southern Classification Territory, comprising all or parts of the 11 states east of the Mississippi River and south of the Ohio River.

The location of the Southern Classification Committee headquarters in Atlanta facilitates adjustments in the classification description or ratings

applicable to particular commodities which are, or might be, shipped from Georgia plants.

Rail Facilities

Thirty carriers, of which 11 are Class I railroads, operate about 5,800 miles of line track in Georgia. Map 8 shows that the tracks are well distributed over the state. In fact, all but 11 of the state's 159 counties are served. Seven of the counties without rail service are in the mountainous country of northeast Georgia; south of these the two great plateau corridors meet as mentioned earlier.

Two vast electronic freight yards are operated in Atlanta by the Southern Railway System and by the Louisville & Nashville Railroad Company. Flat yard switching is available at Augusta, Columbus, Macon, and Savannah. Motive power for most lines is completely dieselized.

The four major railroads serving Georgia (Atlantic Coast Line, Central of Georgia, Seaboard Air Line, and Southern Railway System) own and operate more than 120,000 cars. The total includes 48,000 box cars, 21,000 gondola cars, 20,000 hopper cars, and smaller numbers of container, pulp, rack, tank, and ventilator cars.

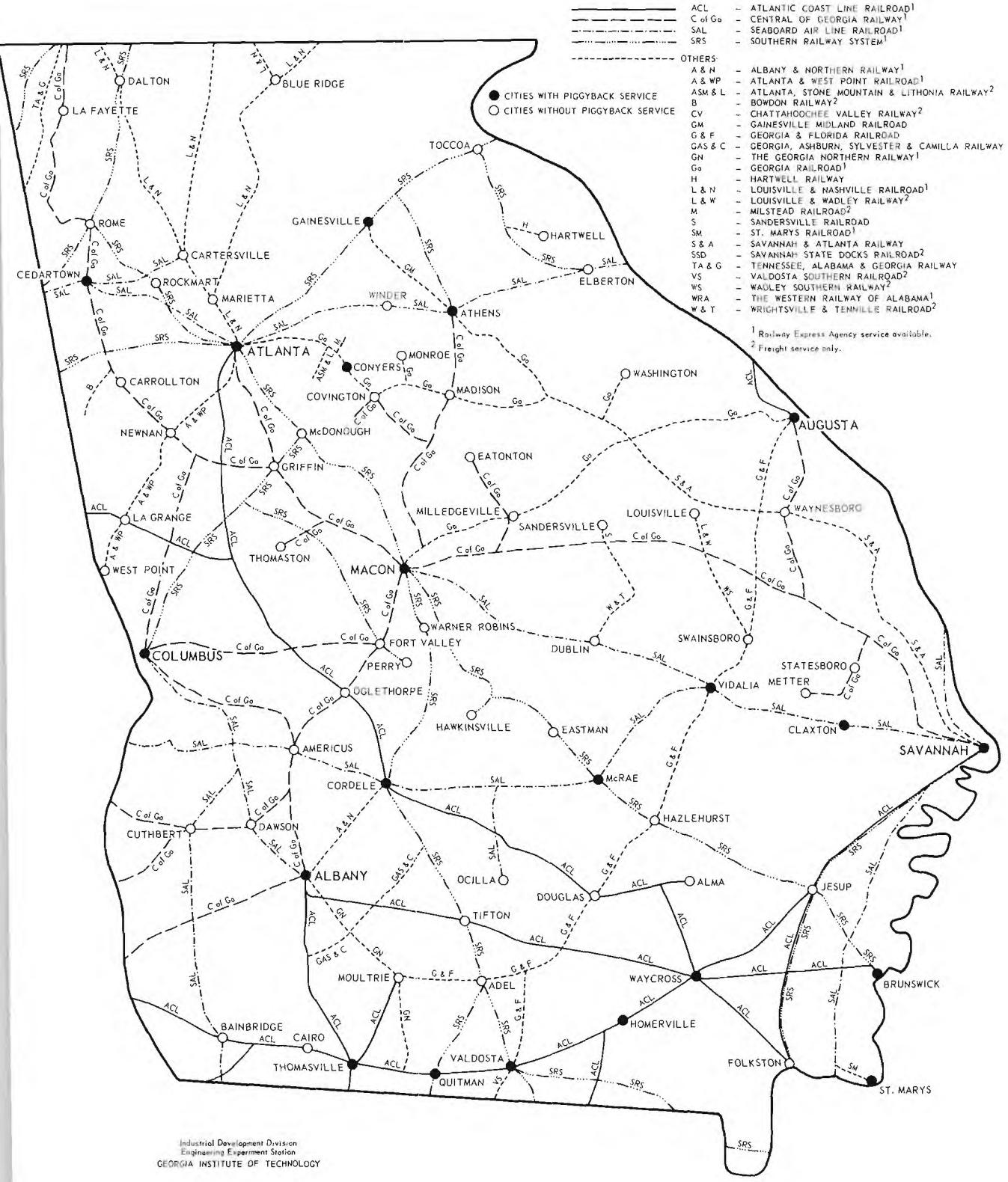
Conforming with nationwide practice, railroads serving Georgia seldom provide rail equipment or cars specially designed for a single shipper's needs. However, they have led the railroad industry in designing modern cars with broad applications. Examples include 5,000-cubic-foot aluminum covered hopper cars with capacities of more than 100 tons, freight cars with roll-up sides, and 10,000-cubic-foot box cars. New cars may be equipped with hydraulic shock absorption devices.

Routings from several points in Texas and Louisiana to points in Georgia have been checked and are adequate for handling the new 30,000-gallon tank car.

Piggyback Service

Trailer-on-flatcar rail service, better known as "piggyback," is available at 21 cities in Georgia. (See Map 8.)

MAP 8
RAILWAY MAP OF GEORGIA



Of the five basic piggyback plans, plans 2 and 3 are the standard service in Georgia. Under plan 2, the railroad owns or leases trailers and bills the shipper direct for its services at rates competitive with those charged by trucking firms. The railroad provides door-to-door service and deals with the shipper on a direct basis.

Plan 3 provides that railroads carry trailers owned or leased by shippers, at a flat rate per mile. The shipper delivers trailers to the railroad, and the railroad puts them aboard flatcars, ties them down, transports them to their destination, and grounds them. The shipper picks them up at the rail terminal.

Plans 1 and 4 are little used in Georgia; plan 5 is nonexistent, according to published tariffs. Under plan 1, railroads carry trailers owned by motor common carriers. The shipper pays regular truck rates to the motor carrier and has no contact himself with the railroad. Under plan 4, the railroad provides only motive power and rails. The shipper provides owned or leased flatcars and trailers and takes care of pickup, delivery, loading, unloading, and tie down. Charges are assessed on a movement basis without commodity classifications. Plan 5 is similar to plan 1, operationally. Normally it involves a truck road haul on one or both ends of the rail movement; the shipper pays joint rail-truck rates.

Specific piggyback service plans available between 13 Georgia cities and selected cities in other states are presented in Table 7. Not surprisingly, Georgia's two most populous cities, Atlanta and Savannah, have connections with all of the listed cities. The table also shows the number of intrastate connections available to each of the Georgia locations.

In addition to the 50 interstate connections shown in Table 7, the following 20 cities are linked to five or more Georgia cities by piggyback service:

Hartford, Conn.
Indianapolis, Ind.
Clifton, N. J.
Jersey City, N. J.
Newark, N. J.
Passaic, N. J.
Patterson, N. J.
Albany, N. Y.
Rochester, N. Y.
Schenectady, N. Y.
Syracuse, N. Y.
Troy, N. Y.
Durham, N. C.
Akron, O.
Cleveland, O.
Dayton, O.
Warren, O.
Youngstown, O.
Pittsburgh, Pa.
Providence, R. I.

SELECTED GEORGIA PIGGYBACK SERVICE CONNECTIONS

	Albany	Athens	Atlanta*	Augusta	Brunswick	Columbus	Gainesville	Macon	St. Marys	Savannah	Thomasville	Valdosta	Waycross	Total No. of Connections with Georgia Cities
Intrastate connections (number)	13	7	12	11	7	8	7	11	7	13	7	8	8	
Interstate connections (plans in effect to and from selected cities):														
Baltimore, Md.			1-2-3	2		2		2-3		1-2-3				7
Birmingham, Ala.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Boston, Mass.			2-3	2-3		2		2-3		2-3				6
Buffalo, N. Y.	3		2-3	2-3	3	2-3		2-3		2-3	3		3	9
Charleston, S. C.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Charlotte, N. C.	2-3	2-3	2-3			2-3	2-3	2-3	2-3	2-3		2		9
Chattanooga, Tenn.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Chicago, Ill.			1-2-3	2	2		2	3	2	2-3	2			9
Cincinnati, Ohio	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Columbia, S. C.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Columbus, Ohio			2	2	2	2		2	2	2	2(a)	2	2	16
Dallas, Tex.	2	2	2-3	2	2	2	2	2	2	2-3	2		2	14
Detroit, Mich.	2	2	1-2-3-4(b)	2	2	2	2	2-3	2	2-3	2	2	2	20
Ft. Lauderdale, Fla.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Ft. Worth, Tex.	2	2	2	2	2	2	2	2	2	2	2		2	12
Gary, Ind.			2	2	2		2		2	2	2			7
Greenville, S. C.	2-3		2-3	2-3	2-3	2-3		2-3		2-3	2-3	2-3	2-3	11
Hammond, Ind.			1-2-3	2	2		2		2	2	2			7
Houston, Tex.	2	2	2	2	2	2	2	2	2	2	2		2	12
Huntsville, Ala.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	3	2-3	14
Jacksonville, Fla.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	1-2-3	2-3	2-3	2-3	13
Knoxville, Tenn.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Lake Charles, La.	2	2	2	2	2	2	2	2	2	2	2		2	12
Lexington, Ky.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Little Rock, Ark.	2	2	2	2	2	2	2	2	2	2	2		2	12
Louisville, Ky.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Memphis, Tenn.	2-3	2-3	1-2-3-4	2-3-4	2-3	2-3-4	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Miami, Fla.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	1-2-3	2-3	2-3	2-3	13
Mobile, Ala.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	13
Monroe, La.	2	2	2	2	2	2	2	2	2	2	2		2	12
Montgomery, Ala.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	13
Nashville, Tenn.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
New Orleans, La.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
New York, N. Y. (c)			1-2-3	2		2		2-3		1-2-3				7
Norfolk, Va.	2-3	2-3	1-2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	1-2-3	2-3	2-3	2-3	15
Oklahoma City, Okla.	2	2	2	2	2	2	2	2	2	2	2		2	12
Orlando, Fla.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	1-2-3	2-3	2-3	2-3	14
Pensacola, Fla.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Philadelphia, Pa.			1-2-3	2		2		2-3		1-2-3				7
Portsmouth, Va.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
Raleigh, N. C.	2-3	2-3	2-3			2-3	2-3	2-3	2-3	2-3				8
Richmond, Va.	2-3	2-3	1-2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	1-2-3	2-3	2-3	2-3	14
St. Louis, Mo.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	1-2-3	2-3	2-3	14
St. Petersburg, Fla.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	14
San Antonio, Tex.	2	2	2	2	2	2	2	2	2	2	2		2	14
Shreveport, La.	2	2	2	2	2	2	2	2	2	2	2		2	12
Tampa, Fla.	2-3	2-3	1-2-3	2-3	2-3	2-3	2-3	2-3	2-3	1-2-3	2-3	2-3	2-3	14
Washington, D. C.	2	2	2	2	2	2	2	2	2	2	2	2	2	13
West Palm Beach, Fla.	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3	13
Winston-Salem, N. C.	3		3	3	3	3	—	3		3	3	3	3	10

Notes:

* - The following cities in the Atlanta area have the same piggyback services as Atlanta: Chamblee, College Park, Decatur, Doraville, East Point, Forest Park, Hapeville, and Smyrna, plus certain smaller urban places.

(a) - Plan 2 on a specific commodity only, from Thomasville to Columbus, Ohio, only.

(b) - Plan 4 on a specific commodity only, from Detroit, Michigan, to Atlanta only.

(c) - Kearny, New Jersey, only on plans 1 and 3 to and from Atlanta, on plan 3 to and from Macon, and on plans 1 and 3 to and from Savannah.

Transit Times

Approximate rail transit times from Atlanta to continental United States cities with a 1960 population of 100,000 or more are shown on Map 9. Presented in days, transit time shown excludes the day the bill of lading is signed, but includes the day the car is delivered before 5 p.m. If a car must be switched from one railroad company to another within either the originating or destination city, an additional day is generally necessary for each switching operation.

Transit time on shipments from principal points in Georgia other than Atlanta will usually be one day more if routed through Atlanta. Transit time on shipments not routed through Atlanta may be one day more or less than the time shown on Map 9, depending on the distance from the destination relative to Atlanta's distance from the destination.

Shippers may, of course, request expedited service. Certain types of traffic, such as piggyback or perishables, by their nature receive expeditious service.

The transit time advantage accruing to Atlanta from its position south of the Appalachian Mountain Range is indicated in Table 8. Transit time is given from Atlanta, Chicago, and New York to seven destinations, six of which are north of the Ohio River.

Shipments from Atlanta reach eastern points as quickly as shipments from Chicago; shipments from Atlanta reach midwestern points as quickly as shipments from New York. An Atlanta manufacturer can ship rail cars to all seven destinations nearly as quickly as a Chicago or New York manufacturer, although six of the seven destinations lie in the northern industrial belt.

Transit time for both the New York Central Railroad Company (NYC) and the Pennsylvania Railroad Company (PRR) is shown because their proposed merger is expected to shift a large part of PRR long-haul traffic to the NYC tracks, a shift which could increase transit time between eastern and midwestern points.

MAP 9

RAILROAD FREIGHT SERVICE: NORMAL TRANSIT TIMES ON CARLOAD SHIPMENTS FROM ATLANTA, GEORGIA

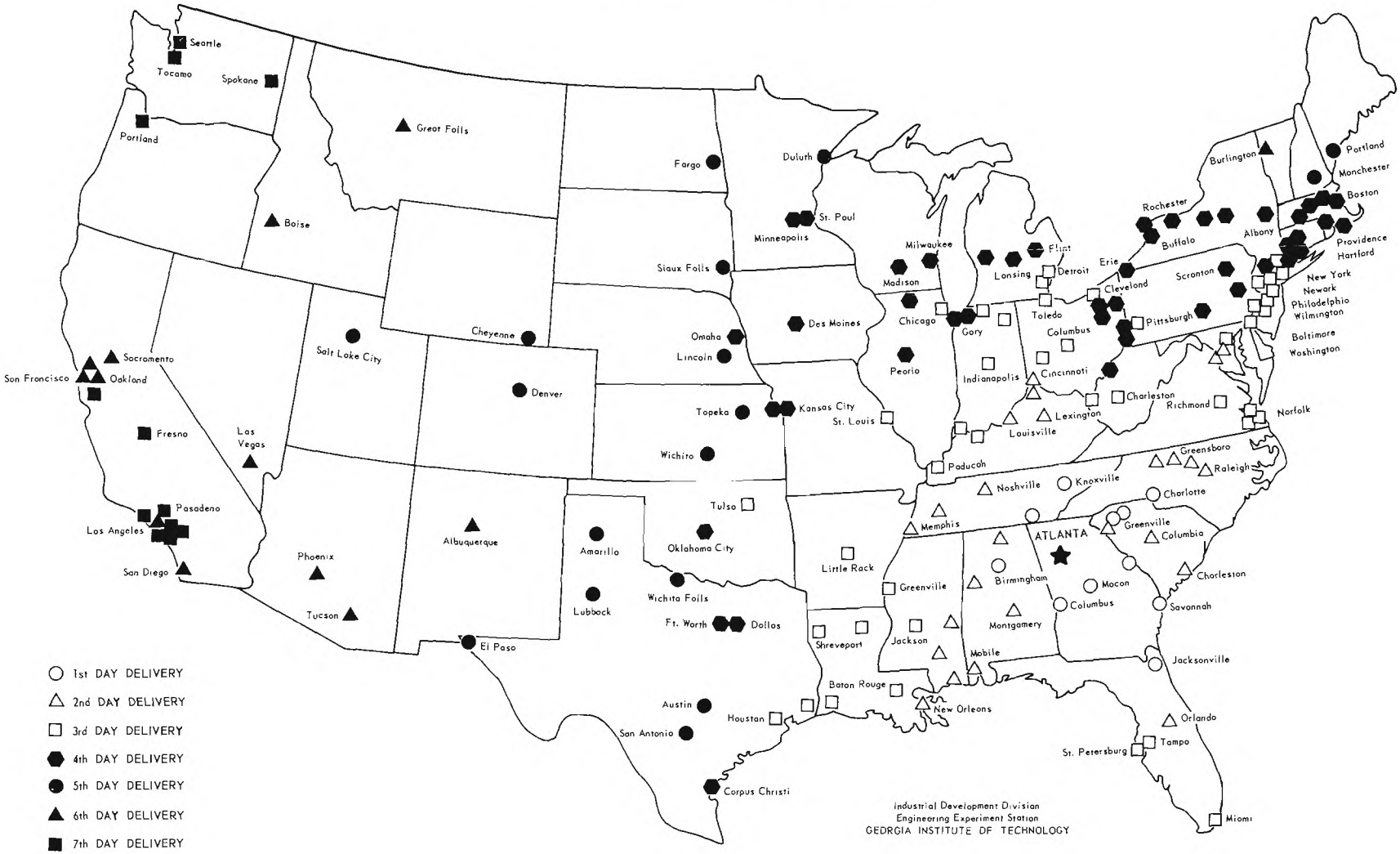


Table 8

TRANSIT TIMES ON CARLOAD SHIPMENTS
FROM ATLANTA, CHICAGO, AND NEW YORK

(in days)

	FROM:						
	Atlanta	Chicago			New York		
TO:	Best	NYC	PRR	Best	NYC	PRR	Best
Atlanta				3			3
Chicago	3	-	-	-	4	3	3
Cincinnati	2	3	2	2	4	3	3
New York	3	4	3	3	-	-	-
Pittsburgh	3	4	2	2	-	2	2
St. Louis	3	3	3	3	4	3	3
S. Philadelphia	3	-	3	3	-	1	1
Best Total	17			16			15

NYC - New York Central Railroad Company

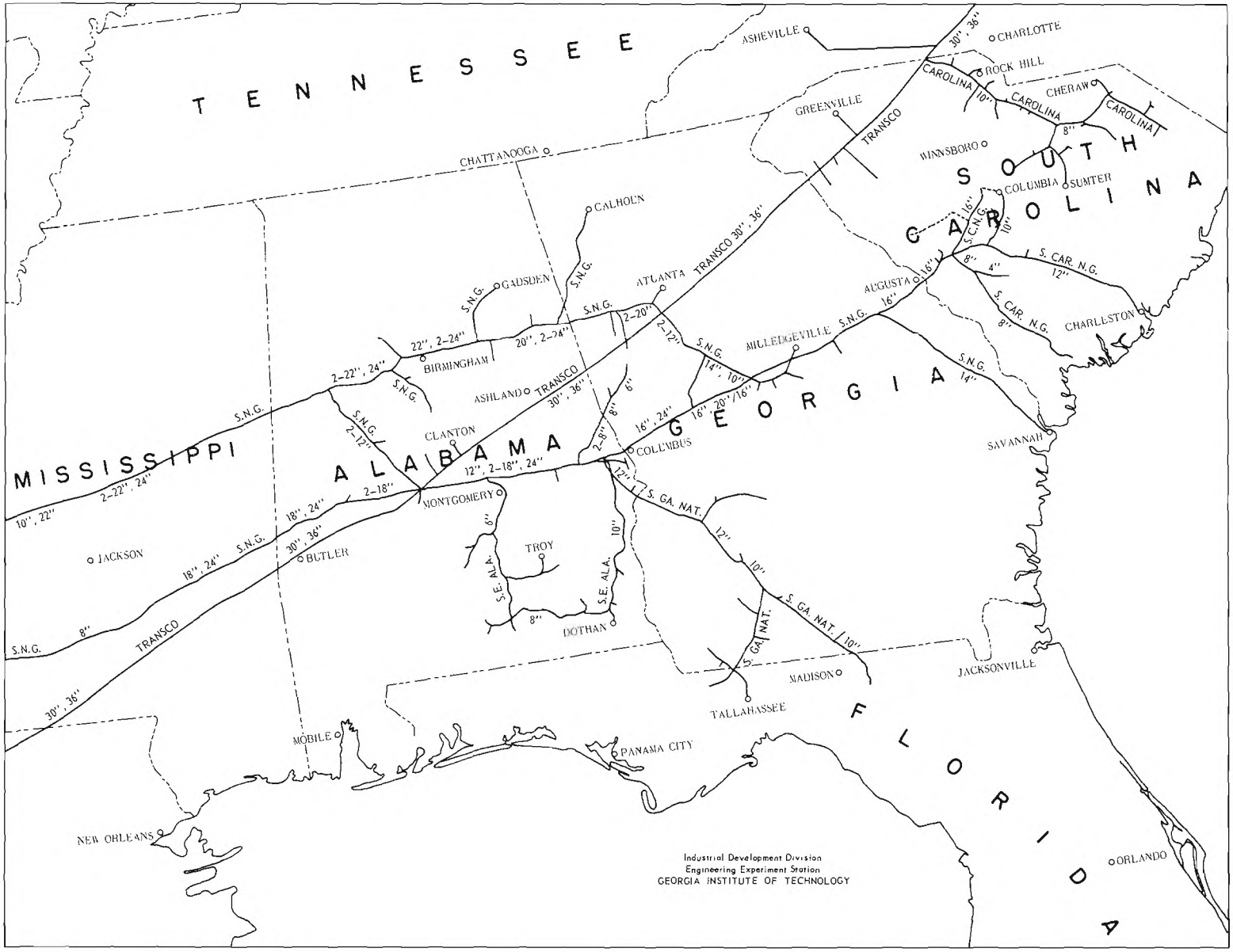
PRR - Pennsylvania Railroad Company

Pipelines

Seven transportation companies operate pipelines in Georgia. Natural gas pipelines operated by Southern Natural Gas Company, South Georgia Natural Gas Company, and Transcontinental Gas Pipe Line Corporation are shown on Map 10. Map 11 shows a portion of the petroleum products pipeline systems operated by Colonial Pipeline Company (under construction), Plantation Pipe Line Company, and Southeastern Pipe Line Company, and the liquefied petroleum gas line operated by Dixie Pipeline Company.

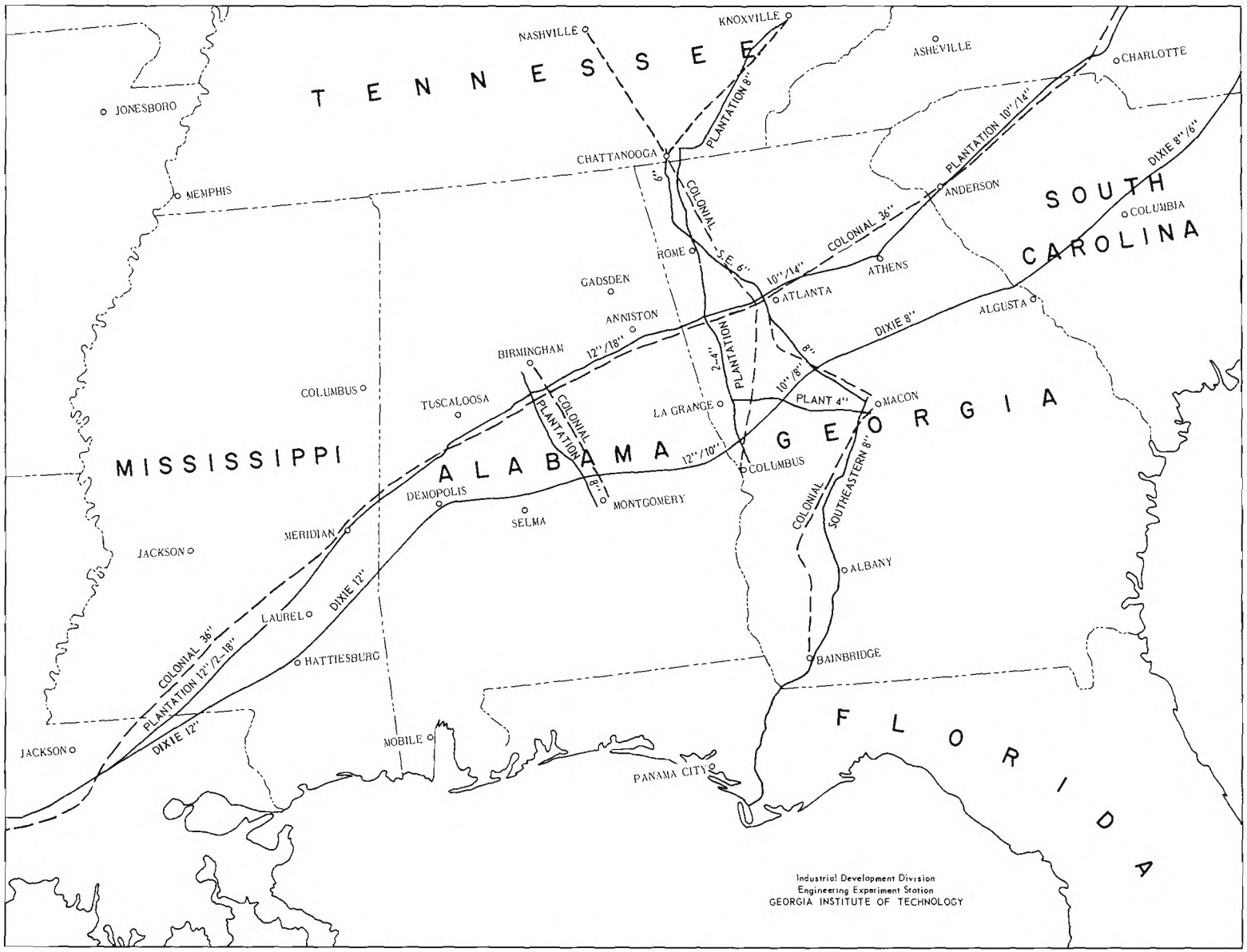
Since industrial consumers generally purchase natural gas from distribution rather than transportation companies, no further detail on gas transportation companies is presented in this report. Details on the natural gas distribution companies operating in Georgia are presented in the section entitled "Fuels," in the chapter on "Other Resources in Georgia."

MAP 10
NATURAL GAS PIPELINES



MAP 11

LIQUEFIED PETROLEUM GAS AND REFINED PRODUCTS PIPELINES



Petroleum Products Pipelines

Plantation Pipe Line Company. Originating in Baton Rouge, Louisiana, the oil products pipeline system operated by Plantation Pipe Line Company includes one 10-inch and one 14-inch line which run through Georgia in a northeastern direction from Bremen to Hartwell. Other lines extend from Bremen north to Chattanooga and Knoxville, Tennessee (one 8-inch line); from Bremen south to LaGrange (two 4-inch lines); from LaGrange south to Columbus (one 4-inch line); and from LaGrange east to Macon (one 4-inch line). Terminals serving the state are located at Bremen, Atlanta, Athens, Macon, and Columbus.

The carrier accepts tenders for gasoline and petroleum oil distillates when products of similar quality and color are currently being transported from the receiving point to terminal points. Color shall not be darker than No. 3 National Petroleum Association specifications. Minimum tender is 25,000 barrels (42 U. S. gallons per barrel). Quantities of not less than 5,000 barrels, from one consignor to one consignee, may be offered for shipment at Baton Rouge, Louisiana. These products will be transported by the carrier when a minimum batch of 25,000 barrels from one consignor to one consignee has been accumulated. Deliveries may be made in quantities of not less than 2,500 barrels each to one or more of the pipeline terminals. Gasoline or petroleum oil distillates will be received for interstate transportation only when the shipper or consignee has provided the necessary storage tanks and facilities for receiving the products.

Rates in cents per barrel are as follows:1/

To	From Baton Rouge Station, La.	From Collins Station Covington County, Miss.
Athens	22.5	18.5
Atlanta	20.7	16.7
Bremen	19.0	15.0
Columbus	27.3	23.3
Macon	29.2	25.2

In addition to the above, the receiving charge for all products offered to the carrier for shipment over dock space provided by the carrier is three cents per barrel. When the products are not offered to carrier for shipment

1/ Tariff issued May 12, 1961.

over dock space, but are offered for shipment at Dock Station, Baton Rouge, the products are subject to a charge of one cent per barrel. When barges do not have unloading equipment, Plantation will supply cargo unloading facilities at a charge of one cent per barrel. The carrier will supply power, a connection crew, connection hose, stand-by men, and dock space to shippers.

Additional information may be obtained from the offices of the Plantation Pipe Line Company, 161 Spring Street Building, N. W., Atlanta, Georgia.

Southeastern Pipe Line Company. Southeastern Pipe Line Company operates an oil products pipeline which runs northward from Port St. Joe, Florida, through Georgia to Chattanooga, Tennessee. Terminals in the state are located at Albany, Americus, Atlanta, Bainbridge, Griffin, Macon, Rome, and Lookout Mountain (Walker County, Georgia). A branch of the pipeline runs between the Atlanta terminal and a terminal in Doraville which serves Dobbins Air Force Base.

The 8-inch line has a capacity of 135,000 barrels daily, with an additional capacity of 56,000 barrels for the Doraville terminal. Tenders of gasoline and kerosene or other petroleum oil distillates will be accepted for transportation if they are of the same quality and general characteristics as the products that are being transported from receiving point to delivery points.

Minimum tender is 25,000 barrels. Rates in cents per barrel (42 U. S. gallons) from Port St. Joe to the Georgia terminals are as follows:[1/]

To	From Port St. Joe, Fla.
Albany	16.5
Americus	17.0
Atlanta	18.5
Bainbridge	12.0
Griffin	18.0
Lookout Mountain	21.5
Macon	17.5
Rome	20.0

1/ Tariff issued August 29, 1958.

In addition to the transportation rate, a charge of 5.5 cents per barrel is made when shippers use the pipeline's 37,500-barrel tank at Port St. Joe for testing and making deliveries into the suction lines.

Additional information may be obtained from Southeastern Pipe Line Company, 777 West Peachtree Street, N. E., Atlanta 8, Georgia.

Colonial Pipeline Company. Colonial Pipeline Company is constructing a third petroleum products pipeline through Georgia. Originating at Gulf Coast refineries near Houston and Lake Charles, it will pass through 14 states and terminate at the New York Harbor area. The first 1,000 miles of the 1,600-mile-long main-line system will be 36 inches in diameter. About 1,000 miles of spur lines are planned. Initially, the line will transport over 600,000 barrels of petroleum products per day.

Colonial's system is scheduled for completion in late 1963. At this writing tariff rates, rules, and regulations are not available. Additional information may be secured from Colonial Pipeline Company, 3330 Peachtree Road, N. E., Atlanta 5, Georgia.

Liquefied Petroleum Gas Line

Dixie Pipeline Company operates a liquefied petroleum gas (LPG) line extending from Texas through Georgia to North Carolina. Terminals serving the state are located at Opelika, Alabama, at Griffin, Georgia, and at Columbia, South Carolina.

The 10-inch line has a capacity of 50,000 barrels daily. The carrier is presently accepting tenders for propane which conforms with the definition of and specifications for "commercial propane" delineated in "N.G.P.A. Liquefied Petroleum Gas Specifications and Test Methods." Dixie will, however, consider liquid shipments other than propane and issue tariffs for acceptable materials.

Minimum tender is 7,000 barrels in any one calendar month from all origins to all destinations. Rates in cents per barrel (42 U. S. gallons) from seven origins to the three terminals serving Georgia are as follows:[1/]

1/ Tariff issued December 5, 1961.

From:	To Opelika Ala.	To Griffin Ga.	To Columbia S. C.
Breaux Bridge, La.	53	62	83
Demopolis, Ala.	20	29	50
Hattiesburg, Miss.	33	42	63
Lake Charles, La.	62	71	92
Mont Belvieu, Tex.	74	83	104
N. Baton Rouge, La.	48	57	78
Port Acres, Tex.	69	78	99

Rates are subject to an additional charge of 10 cents per barrel when the service of loading into tank trucks or tank cars is performed at terminals. Dixie has provided such handling facilities at all terminals and will load propane upon the shipper's order, provided that no single loading of less than 5,000 U. S. gallons will be made.

Additional information may be secured from Dixie Pipeline Company, Post Office Box 4673, Atlanta 2, Georgia.

Highway Transportation

Highway transportation derives the same benefits as rail transportation from Georgia's position at the intersection of the midwestern and Eastern Seaboard plateaus. It derives further benefits from the state's equable climate. Highways can be built with few curves and suffer little damage from freezing. Days when roads are impassable due to snow or ice occur infrequently and only in north Georgia.

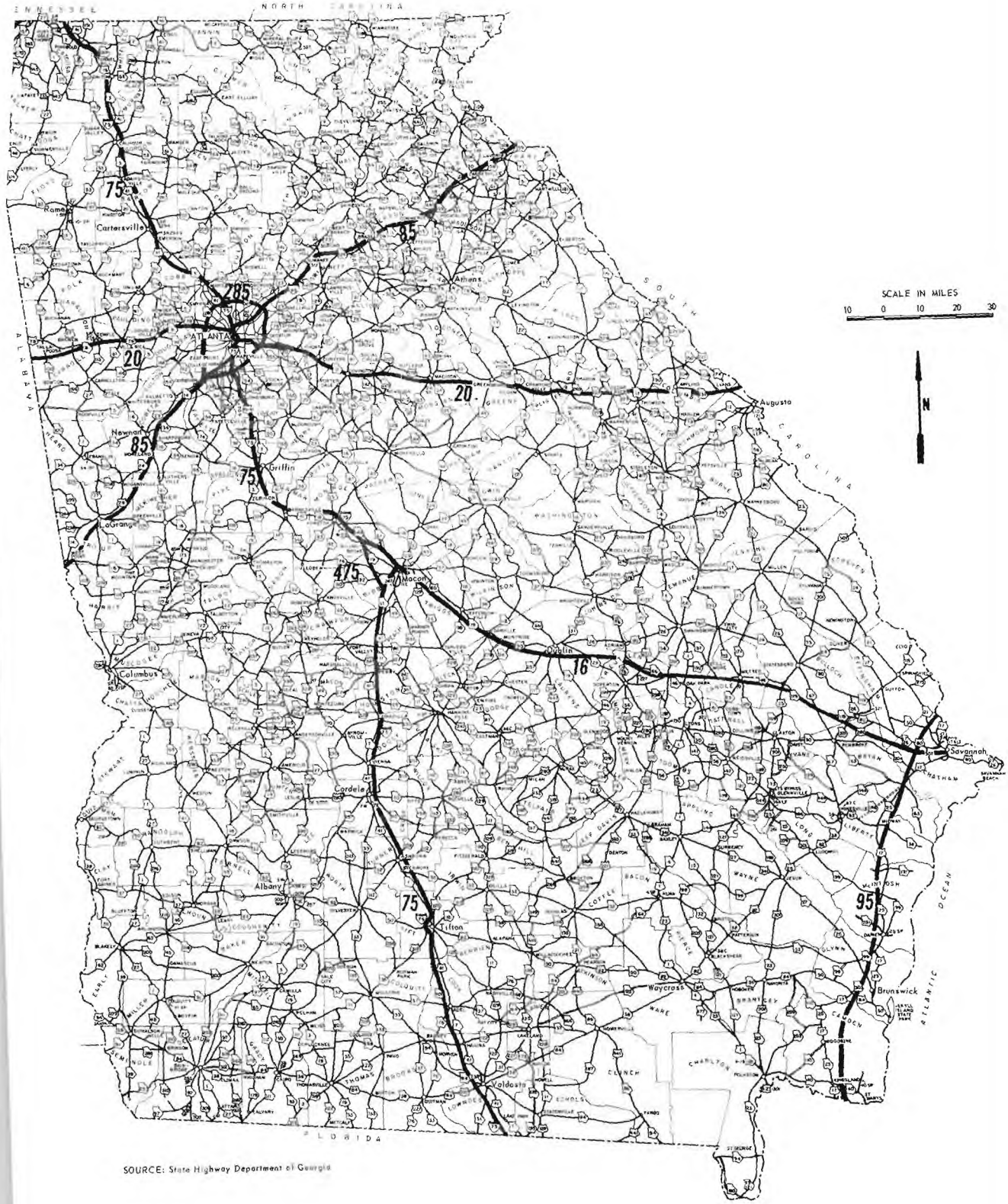
Highway System

The existing mileage of highways, roads, and streets in Georgia totaled some 97,000 miles in 1960, of which about 13,000 miles were municipal and 84,000 rural. (See Map 12.) The total represented 166 road miles per 100 square miles of land area, far more than the national average of 117. Much of it requires extensive improvement, however.

As a major step toward meeting this need, the State Highway Department, which certifies 16,300 miles of Georgia's road system, let contracts for the widening and resurfacing of 7,250 miles of primary and secondary roads during

MAP 12

HIGHWAY MAP OF GEORGIA



SOURCE: State Highway Department of Georgia

the 14 months preceding September 1962. This activity was undertaken as the major part of a $100 million bond-financed program exclusively designed to improve the state's existing highway system.

The National System of Interstate and Defense Highways will include 1,128 miles of four-lane, limited-access highways in Georgia. Although shown on Map 12, only small segments of these highways have been completed.

Among 59 Georgia cities with populations of at least 5,000 (1960 Census figures), 30 are expected to be on or within a few miles of the planned routes of the new interstate highways. These cities, each of which has rail service, are the following:

Atlanta*	Decatur*	Marietta*
Augusta	Dublin	Newnan
Brunswick	East Point*	North Atlanta*
Carrollton	Forest Park*	Perry
Cartersville	Fort Valley	Savannah
Chamblee*	Garden City	Smyrna*
College Park*	Griffin	Statesboro
Cordele	Hapeville*	Tifton
Covington	LaGrange	Valdosta
Dalton	Macon	Warner Robins

The cities marked with an asterisk (*) are legally independent cities located within the Atlanta Standard Metropolitan Area.

Georgia's highway traffic density in 1958 was below the national average -- 12,490 gallons of motor fuel consumed per mile of road, as compared with 15,360 in the U. S.

Motor Carriers

Service. Georgia is served by about 100 scheduled motor carriers, many of which operate wholly in interstate transportation, with some 400 irregular route carriers, contract haulers, and specialized commodity carriers. The total number of carriers operating exclusively in interstate commerce is estimated by the Georgia Public Service Commission to be about 3,000. The large number of carriers creates competition for freight which tends to reduce rates and improve service.

Direct, single-line service between major U. S. cities and Georgia points is furnished by numerous interstate carriers. Map 13 shows the number of carriers providing direct service from Atlanta to principal cities in the

U. S. Points for which this information is presented include all continental U. S. cities with a 1960 population of 250,000 or more, plus 26 smaller cities. The count of motor common carriers for hire includes only those which have been certificated by the Interstate Commerce Commission to transport "general commodities" with the "usual exceptions."

The following carriers provide direct service to five or more of the cities shown on Map 13:

Associated Transport, Inc.
Bowman Transportation, Inc.
Carolina Freight Carriers Corporation
Dixie Ohio Express, Inc.
Gordon's Transports, Inc.
Hennis Freight Lines, Inc.
Hoover Motor Express Company, Inc.
Johnson Motor Lines, Inc.
McLean Trucking Company
Mercury Motor Express, Inc.
Pilot Freight Carriers, Inc.
Roadway Express, Inc.
Ryder Truck Lines, Inc.
T. I. M. E. Freight, Inc.
Terminal Transport Company, Inc.
Transcon Lines
Watson-Wilson Transportation System

Because carriers interchange trailers with reliable connecting carriers at terminal points, shippers may receive additional through service on truckload shipments to points beyond the line of the original carrier. Consequently, competition for freight is even greater than that indicated by Map 13. While such service technically is joint-line, it is tantamount to single-line service from the shipper's point of view, since the shipment remains in the same trailer from the origin to the destination.

The number of motor carriers having certificated interstate operating rights to transport "general commodities" with the "usual exceptions" directly to and from 30 Georgia cities is shown below:

Albany	27	Dalton	38	Rome	40
Americus	25	Dublin	24	Savannah	38
Athens	38	Gainesville	35	Thomasville	25
Atlanta	76	Griffin	33	Toccoa	34
Augusta	40	LaGrange	30	Valdosta	27
Bainbridge	25	Macon	36	Vidalia	20
Brunswick	22	Marietta	53	Warner Robins	28
Carrollton	26	Milledgeville	27	Waycross	24
Columbus	36	Moultrie	23	Waynesboro	24
Cordele	25	Newnan	31	Winder	36

MAP 13

NUMBER OF ICC CERTIFICATED GENERAL COMMODITY MOTOR CARRIERS OFFERING DIRECT SERVICE FROM ATLANTA TO PRINCIPAL U. S. CITIES

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Approximately 460 public motor common carriers and contract carriers are licensed to operate in intrastate commerce in Georgia; some of these also operate in interstate commerce. Daily schedules between most Georgia cities are maintained by 35 regular route carriers. Points not served by this group are reached by the irregular route carriers, many of which operate state-wide service.

Most of the carriers serving Georgia have facilities and equipment to handle from 10% to 20% more traffic than they are now handling. Carriers state that they will purchase or lease additional equipment, if necessary, in order to handle additional traffic.

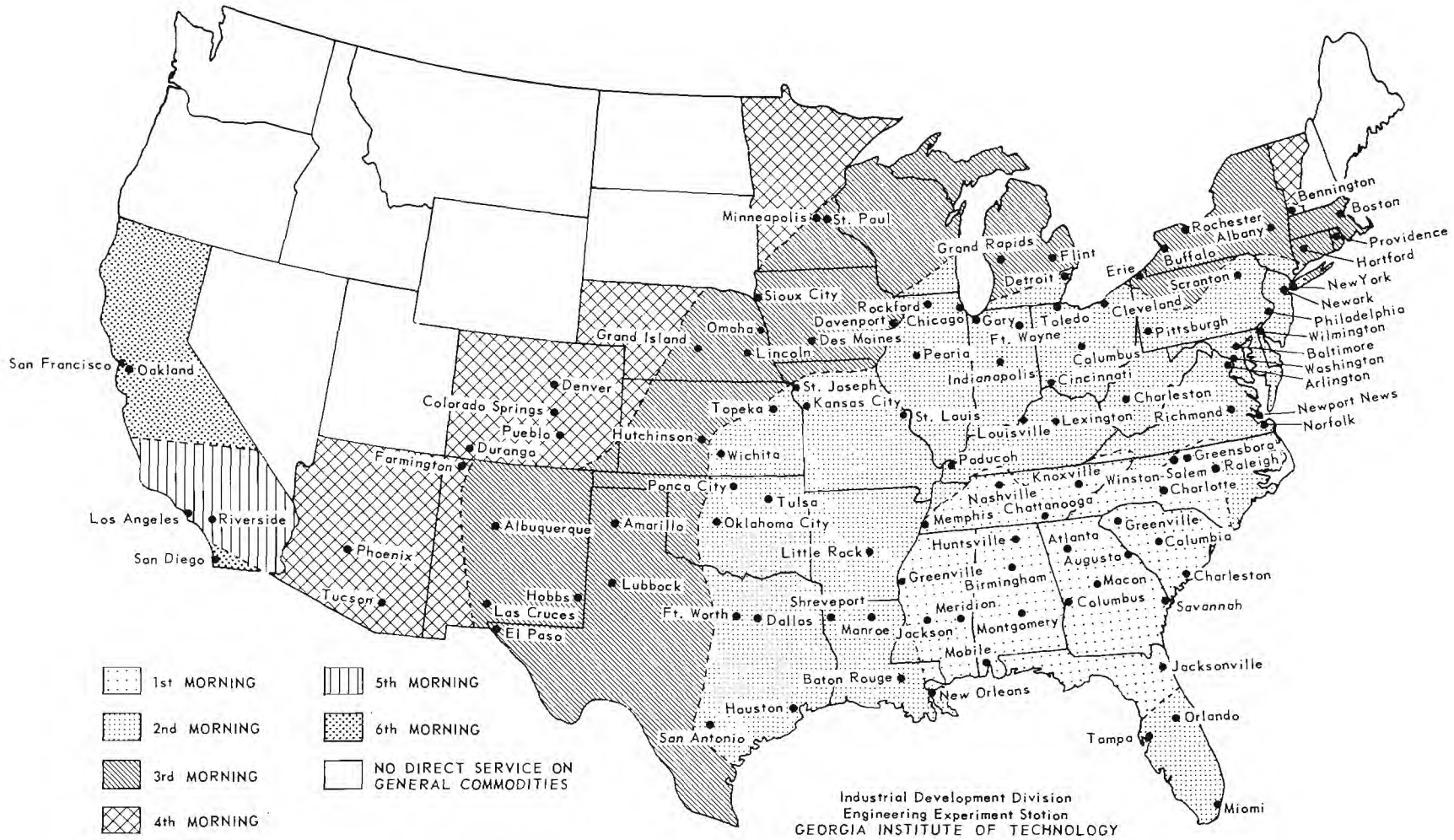
Transit Times. Maps 14 and 15 show the normal motor freight transit times in days (mornings) for shipments from Atlanta. The word "normal" is used because the times were computed from the schedules of a majority of motor common carriers maintaining single-line service on general commodities. The parenthetic "mornings" is used to reflect the common practice of picking up shipments before 5 p.m. at the place of business of the shipper and delivering them to the place of business of the consignee in the early morning. Measured time excludes the day of pickup but includes the day, or morning, of delivery.

Map 14 shows service on truckload (TL) shipments; Map 15 shows service on less-than-truckload (LTL) shipments. Of course, better service is available on TL than on LTL shipments, but service on LTL shipments to large cities generally matches service on TL shipments to the same cities. This is because LTL shipments are first delivered to the terminal nearest the delivery point, usually in a large city, and then reloaded for shipment to the consignee.

The cities and areas to which TL shipments may be sent in one day, or overnight, from each of six Georgia cities are shown in Map 16. Service from the smallest communities in the state to major population centers outside of the Southeast seldom exceeds one day more than service from Atlanta. Important centers such as Chicago, New York, and Philadelphia receive three-day service from most Georgia communities.

MAP 14

TRANSIT TIMES ON DIRECT TRUCKLOAD SHIPMENTS FROM ATLANTA



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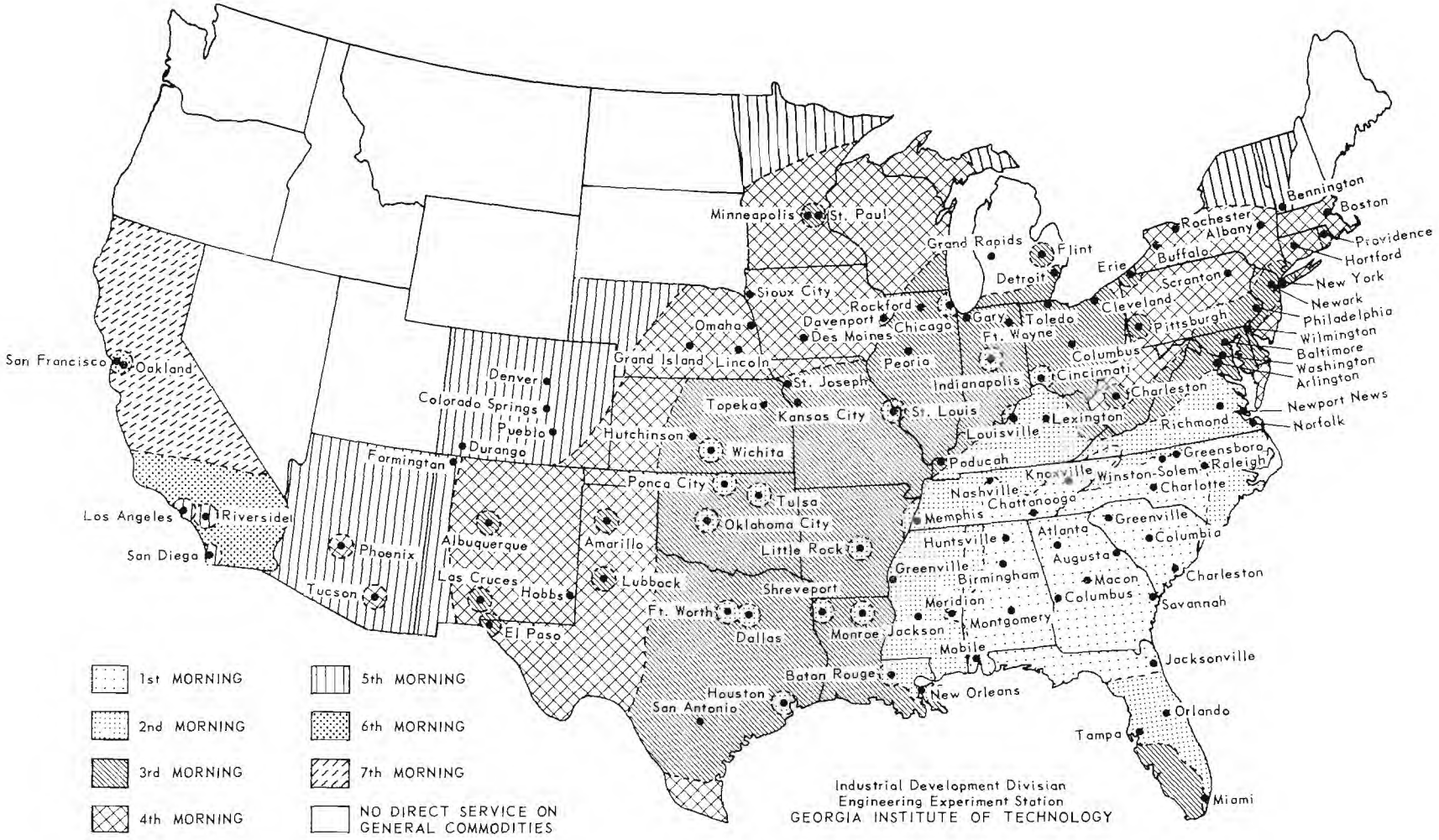
MAP 15

TRANSIT TIMES ON DIRECT LESS-THAN-TRUCKLOAD SHIPMENTS FROM ATLANTA

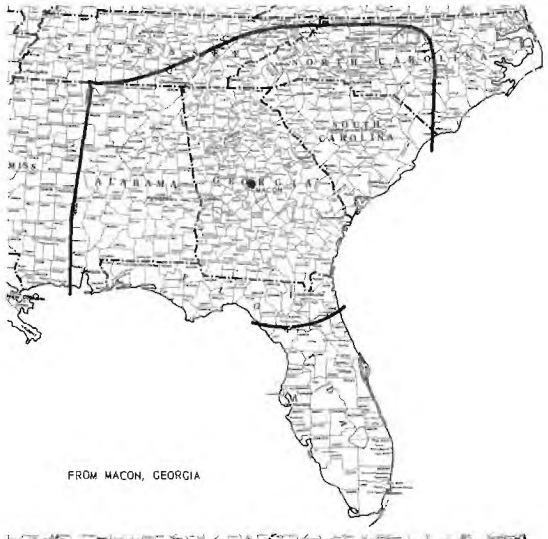


MAP 16

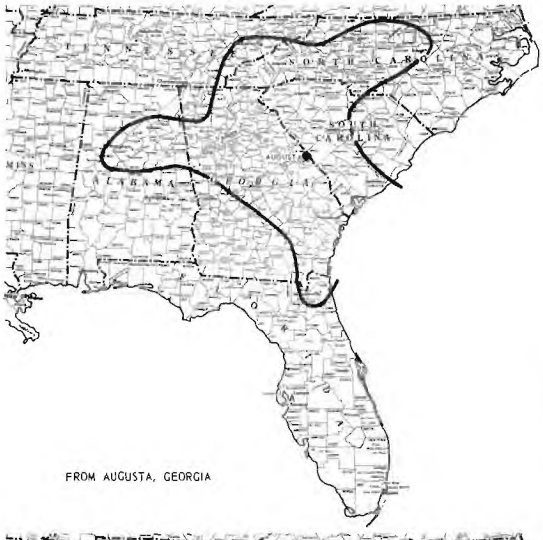
ONE-DAY TRUCKLOAD SERVICE FROM SIX GEORGIA CITIES

FROM ALBANY, GEORGIA

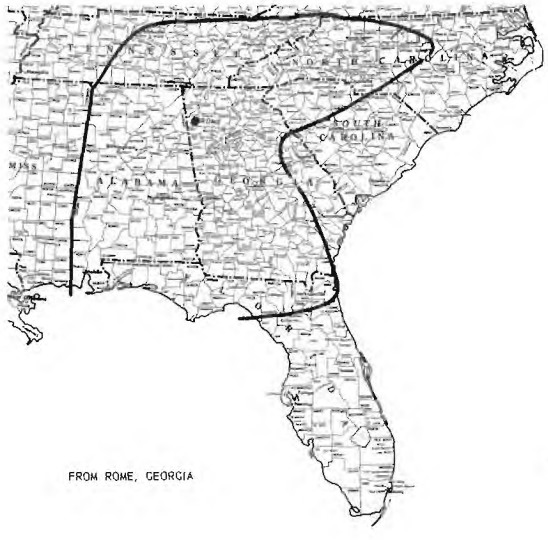
FROM COLUMBUS, GEORGIA



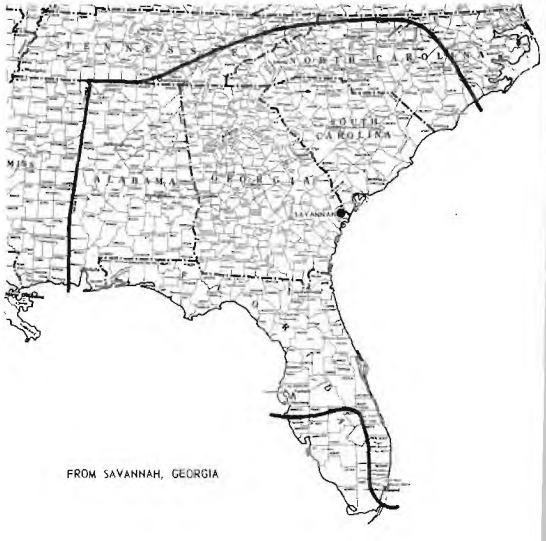
FROM MACON, GEORGIA



FROM AUGUSTA, GEORGIA



FROM ROME, GEORGIA



FROM SAVANNAH, GEORGIA

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Air Transportation

Thirty cities in Georgia maintain at least one paved and lighted airport; 12 of these are served by regularly scheduled commercial flights. Six of the nation's 11 trunk airlines (Delta, Eastern, National, Northwest Orient, Trans World, and United) and two regional airlines (Piedmont and Southern) serve Georgia.

Atlanta is the hub of air transportation in the Southeast, providing far more scheduled daily departures than any other city south of the Ohio River and east of the Rocky Mountains. In fact, only four U. S. cities -- Chicago, Los Angeles, New York, and Washington -- had more airline departures than Atlanta in 1961. The city was tenth in the nation in tons of air cargo carried in that year. Seven commercial airlines provide scheduled flights from the city, and 15 others maintain off-line offices. Some 25 air freight forwarders in the city compete to provide forwarding service.

Map 17 shows those cities which can be reached from Atlanta without changing planes. A total of 52 cities are served with non-stop flights, 31 with one stop, and 51 with more than one stop. Of the 134 cities indicated, 25 are served by pure jets and another 35 are served by prop jets. No attempt has been made to describe service obtainable by changing planes, since all cities served by commercial flights can be reached by doing so.

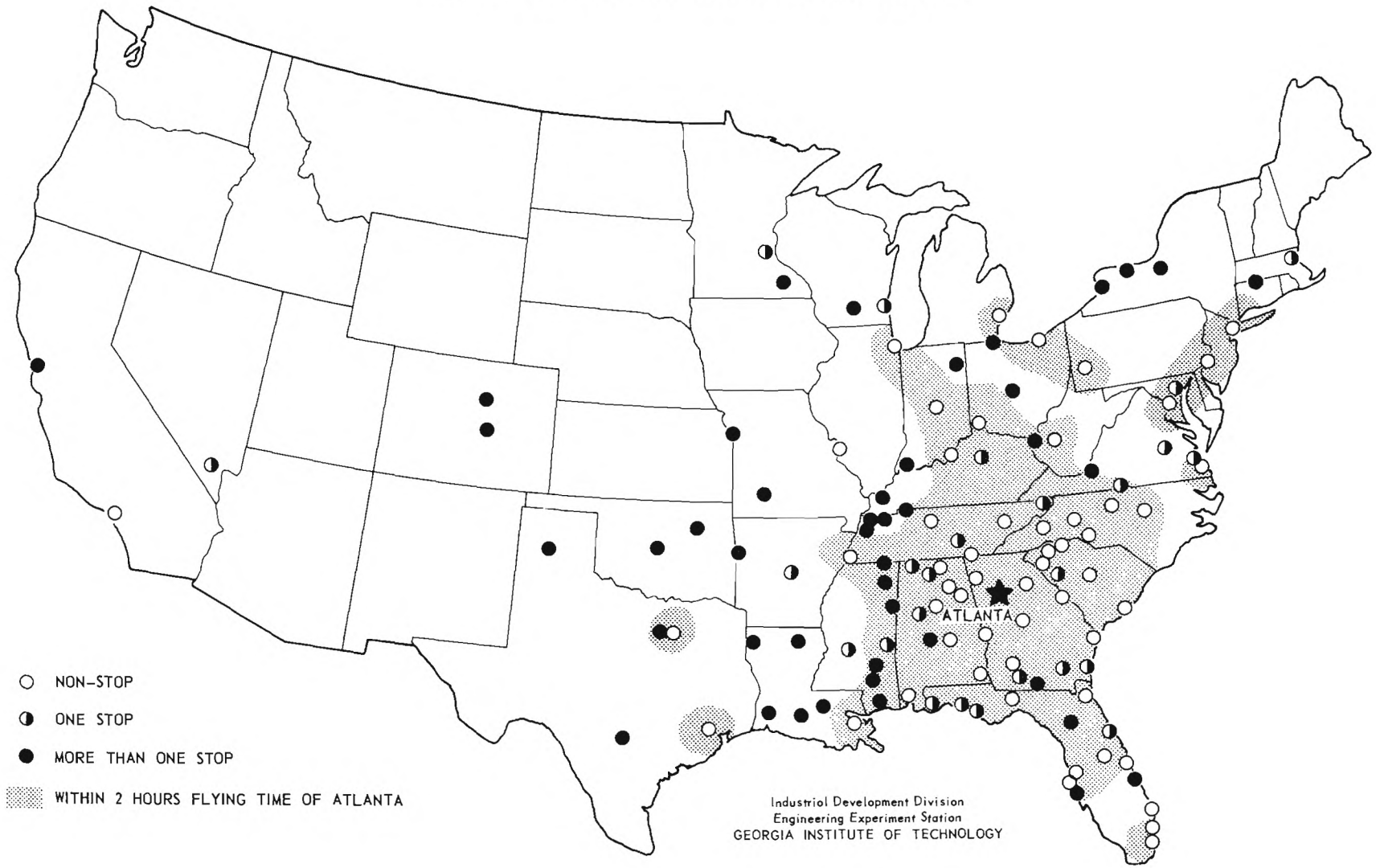
More than 78 million people live within two hours' flying time of Atlanta. The estimate, based on the 1960 Census, includes people living within 50 miles of all cities which are less than two hours' flying time from Atlanta. The shaded area on Map 17 delineates the approximate area in which these people live.

The best flight time to each of 10 cities in the shaded area is as follows:

Charleston, W. Va.	1 hr. 40 minutes
Chicago, Ill.	1 hr. 29 minutes
Dallas, Tex.	1 hr. 45 minutes
Detroit, Mich.	1 hr. 37 minutes
Durham, N. C.	1 hr. 27 minutes
Memphis, Tenn.	55 minutes
Miami, Fla.	1 hr. 26 minutes
New Orleans, La.	1 hr. 2 minutes
New York (Newark)	1 hr. 29 minutes
Pittsburgh, Pa.	1 hr. 40 minutes

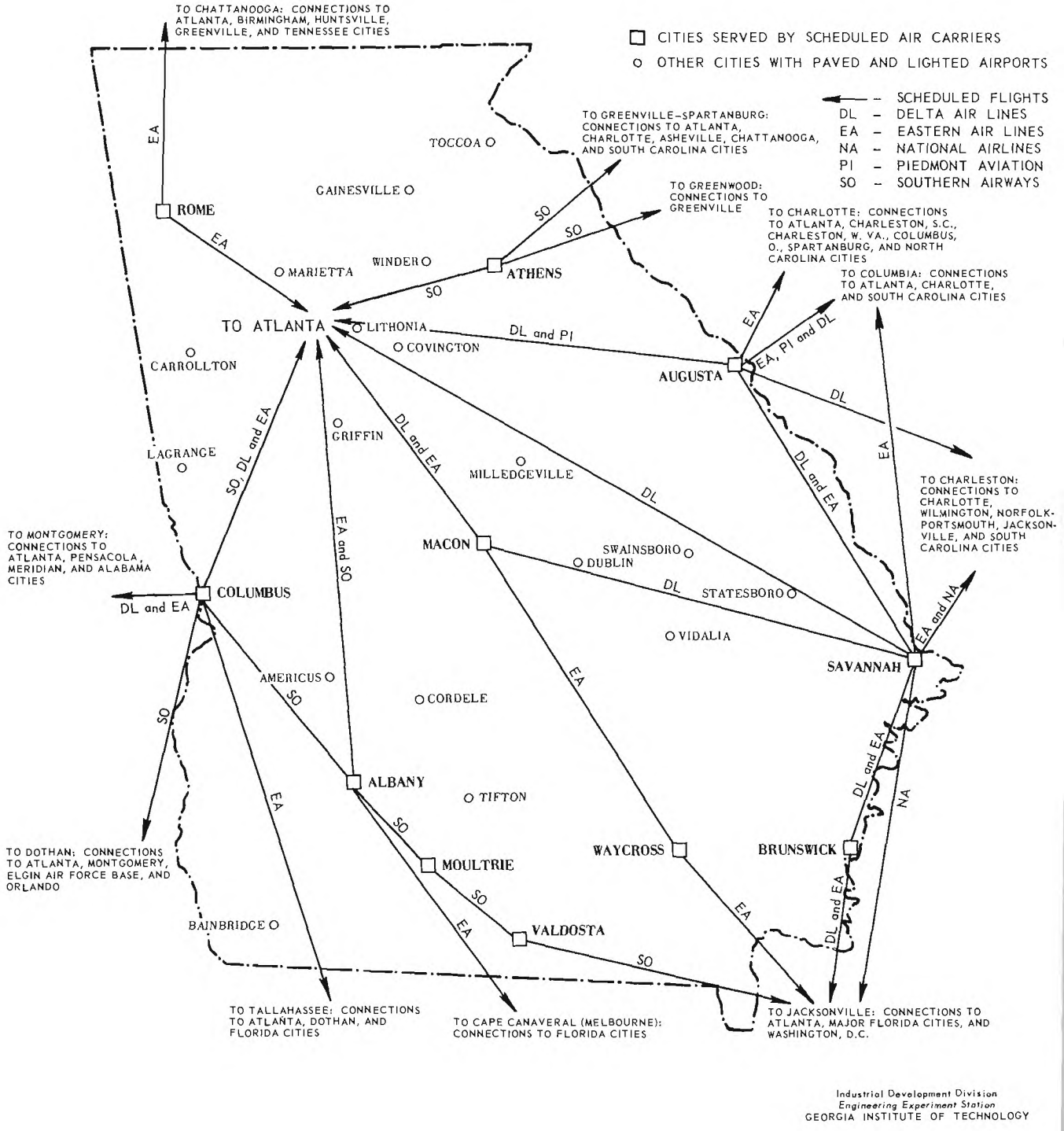
MAP 17

DAILY SINGLE PLANE FLIGHTS FROM ATLANTA



Because Atlanta is the hub of southeastern air transportation, it provides access to long distance flights for other Georgia cities and for cities in other southeastern states. Map 18 shows the non-stop air connections from the 11 cities in Georgia, other than Atlanta, which are served by regularly scheduled commercial flights. Times for the flights shown range from 34 to 65 minutes. The map also shows 18 other Georgia cities with paved and lighted airports. Most of these provide feeder service to commercial airports.

MAP 18
AIR CONNECTIONS FROM GEORGIA CITIES, EXCLUDING ATLANTA



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GEORGIA'S RAW MATERIALS RESOURCES

Basic and Intermediate Chemicals

Georgia produces basic and intermediate chemicals from its few developed mineral and forest resources and also from natural gas, salt, sulfur, and other imported materials. Processors seeking sources of basic and intermediate chemical raw materials in Georgia are not limited to those produced within the state, however. Other chemical raw materials which are economically available include the basic materials which are presently brought into the state, those chemicals which have a uniform price throughout the eastern United States, and those which may be purchased from nearby plants on a freight-equalized basis.

Some of Georgia's sources for basic and intermediate chemicals are described in the following sections.

Chemicals Produced in Georgia

Chemicals produced in Georgia are generally priced to compete in national markets. Sulfuric and hydrochloric acids are sold at much lower prices because of special circumstances.

The state has 16 sulfuric acid plants which are owned and operated by fertilizer producers who sell only excess acid. In addition, American Cyanamid Company has a contact plant at Savannah. But acid prices in Georgia are dominated by the Tennessee Corporation's Copperhill plant, located less than a mile from Georgia's northern border. Because the plant produces acid from pyrites along with iron, zinc, and other metals, prices are low.

Chlorine and caustic soda are produced by Allied Chemical Corporation in a facility at Brunswick with a capacity of 450 tons per day. Olin Mathieson Chemical Corporation maintains terminal facilities for handling chlorine at its Turtle River Docks near Brunswick and has announced a plant for Augusta. While pricing policies for chlorine and caustic concur with generally accepted practices, hydrochloric acid is available at unusually low prices from the Hercules Powder Company plant at Brunswick. Hercules produces hydrochloric acid as a by-product of its insecticide operation.

Ammonia, nitrogen, nitric acid, carbon dioxide, and urea are produced by Southern Nitrogen Company at Savannah. Daily capacities are about 150 tons of anhydrous ammonia, 100 tons of nitric acid, and 50 tons of urea.

Columbia Nitrogen Corporation, jointly owned by Pittsburgh Plate Glass Company and Staatsmijnen in Limburg, is constructing a 300-ton per day anhydrous ammonia plant at Augusta.

Other basic or intermediate chemicals produced in Georgia, as well as those already mentioned, are listed in Table 9. The table also shows the points of manufacture for each product and lists the manufacturers, when they are not too numerous. Additional information on alpha cellulose, tall oil, and tall oil products is presented in the section on forest resources. Not noted there is the fact that Georgia's present tall oil distillation capacity is about 100,000 tons per year.

Availability of Other Chemicals in Georgia

Natural gas, salt, and sulfur can be brought into Georgia for profitable manufacture of selected chemical products because the delivery costs are offset by the economies of production and distribution which can be realized from a Georgia site. In addition, a great number of chemical raw materials are uniformly priced throughout the eastern United States to include delivery costs. Still others may be purchased from nearby plants on a freight equalized basis.

Natural gas is the raw material for the ammonia plant operated by Southern Nitrogen Company at Savannah. The ammonia plant being built by Columbia Nitrogen Company at Augusta also will use natural gas as its raw material. Under rates to be published in early 1964, consumers who use more than 50 million cubic feet per month will purchase interruptible natural gas for 2.6 cents per therm at many locations in Georgia. (See Map 23, "Natural Gas Facilities in Georgia.") Natural gas pipeline companies serving Georgia are shown on Map 10.

Salt is brought into Georgia at Brunswick by Solvay Division of Allied Chemical Corporation. It is solar salt of very high purity (99.6% NaCl minimum) and is shipped from Inagua, Bahama. It is not possible to make a firm statement of salt prices at various locations in Georgia, because they vary with the quantity consumed and because once a plant is established, competition between railroads and barge lines for bulk movement traffic will lower

Table 9

SOME BASIC AND INTERMEDIATE CHEMICALS
PRODUCED IN GEORGIA

Chemical	Producer and Site
Acetanilide	Merck & Co., Inc. (Albany)
Alpha cellulose	Rayonier, Inc. (Jesup)
Aluminum sulfate	American Cyanamid Company (Adairsville); Allied Chemical Corporation (Atlanta, Macon, and Savannah)
Ammonium sulfide	Chemical Products Corporation (Cartersville)
Anhydrous ammonia	Southern Nitrogen Company, Inc. (Savannah); Columbia Nitrogen Corporation (Augusta)
Barium carbonate	Chemical Products Corporation (Cartersville)
Barium chloride	Chemical Products Corporation (Cartersville)
Barium sulfide	Chemical Products Corporation (Cartersville)
Caustic soda	Allied Chemical Corporation (Brunswick)
Carbon dioxide	Southern Nitrogen Company, Inc. (Savannah); others
Chlorine	Allied Chemical Corporation (Brunswick)
Chlorine dioxide	Brunswick Pulp & Paper Company (Brunswick)
Defoamers	Hercules Powder Company (Brunswick); others
o-Dichlorobenzene	Chemical Products Corporation (Cartersville)
p-Dichlorobenzene	Chemical Products Corporation (Cartersville)
Dyes and organic pigments	Augusta Chemical Company (Augusta)
Emulsifiers	Hercules Powder Company (Brunswick); others
Hydrochloric acid	Allied Chemical Corporation (Brunswick); Hercules Powder Company (Brunswick)
Industrial gases	Albany, Atlanta, Augusta, Savannah, Waycross
Iron oxides	New Riverside Ochre Company (Cartersville)
Lead oxides	National Lead Company (Atlanta)
Magnesium sulfate	Tennessee Corporation (Atlanta)
Nitric acid	Southern Nitrogen Company, Inc. (Savannah); Columbia Nitrogen Corporation (Augusta)
Nitrogen	Southern Nitrogen Company, Inc. (Savannah)
Phosphoric acid	Monsanto Chemical Company (Augusta)
Potassium silicofluoride	American Agricultural Chemical Company (Savannah)

Table 9 (continued)

Chemical	Producer and Site
Rosins, stabilized and modified	G & A Laboratories, Inc. (Savannah)
Rosin derivatives	Monsanto Chemical Company (Baxley); Hercules Powder Company (Brunswick); American Cyanamid Company (Valdosta); others
Sodium silicate solutions and glasses	E. I. du Pont de Nemours & Company (Augusta); Chemical Products Corporation (Cartersville)
Sodium silicofluoride	American Agricultural Chemical Company (Savannah)
Sodium sulfide	Chemical Products Corporation (Cartersville)
Sodium sulfhydrate	Chemical Products Corporation (Cartersville)
Sodium tripolyphosphate	Monsanto Chemical Company (Augusta)
Sulfanilamide	Merck & Company, Inc. (Albany)
Sulfuric acid	American Cyanamid Company (Savannah); others
Surface active agents, sulfonated oils and assistants	Atlanta, Cedartown, Columbus, Conyers, Dublin, East Point, Macon, Marietta
Tall oil, crude	Augusta, Brunswick, Jesup, Macon, Port Wentworth, Rome, St. Marys, Savannah, Valdosta
Tall oil fatty acids, tall oil rosins, distilled tall oil	Hercules Powder Company (Brunswick); Owens-Illinois Glass Company (Valdosta); Union Bag-Camp Paper Company (Savannah)
Titanium dioxide	American Cyanamid Company (Savannah)
Urea	Southern Nitrogen Company, Inc. (Savannah)
Zinc sulfate	Tennessee Corporation (Atlanta)

shipping costs. The following is a rough estimate of the cost of 6,000-ton shipload quantities of salt at Augusta:

	Cost per Ton
Salt and freight to Brunswick	$ 8.50
Import duty	.70
Ship to barge transfer cost	1.00
Barge freight -- Brunswick to Augusta	2.00
Unloading at Augusta	.50
Total	$12.70

A molten sulfur handling and storage facility with a capacity of 10,000 long tons was recently built at Savannah under a lease agreement between the Georgia Ports Authority and American Cyanamid. A similar facility has been constructed by Texas Gulf Sulphur Company. Since pricing policies for sulfur pass freight and handling costs on to the purchaser, the new terminals will lower sulfur prices in Georgia. Sulfuric acid prices are already low.

Some chemicals which have a uniform price throughout the eastern United States are listed in Table 10. Most of the chemicals listed are usually priced to include the cost of delivery. The others are priced on a freight-allowed basis, which is the same as delivered basis in terms of funds expended by the purchaser. The only geographic variable in buying these chemicals is service, and purchasers in Georgia have easy access to the complex of chemical distributors in Atlanta.

Large volume chemicals sold on a freight equalized basis are listed in Table 11. Georgia's transportation and distribution systems facilitate delivery to sites within the state, but the essential consideration is the proximity of sources to destinations. Manufacturing points of freight equalization nearest to Georgia are also shown in Table 11.

Mineral Resources[1/]

Georgia has one of the most diversified assemblages of mineral resources in the South, due to the wide range in age and variety of geologic formations found in the state. Altogether, Georgia has over 30 minerals or mineral

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1/ Abstracted from Georgia's Mineral Resources, by George I. Whitlatch, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, June 1962.

Table 10

SOME CHEMICALS PRICED TO INCLUDE DELIVERY COST

Acetaldehyde
Acetanilide
Acetic acid
Acetic anhydride
Acetoacetanilide
Acetoacet-o-chloroanilide
Acetoacet-o-toluidine
Acetone
Acetonitrile
Acetophenone
Acetyltributyl citrate
Acrylic acid
Adipic acid
Aldrin
Allyl alcohol
Allyl chloride
2-Amino-4-chlorophenol
Aminoethyl ethanolamine
2-Amino-2-methyl-1-propanol
Amyl acetate
Amyl alcohol
p-tert Amyl phenol
Aniline
o-Anisidine
Anthraquinone
Antimony oxide
Azelaic acid

Barium nitrate
Barium stearate
Benzene hexachloride
Benzidine hydrochloride
Benzoic acid
n-Benzyl-n,n-dimethylamine
Bone black
Bromine
Butadiene
n-Butyl acetate
n-Butyl acrylate
n-Butyl alcohol
Butyl cyclohexyl phthalate
Butyl lactate
Butyl octyl phthalate
Butyl oleate
Butyl stearate
1,3-Butylene glycol
p-tert-Butylphenol
Butyraldehyde
Butyric acid
n-Butyronitrile

Calcium carbide
Carbon tetrachloride
Cellulose acetate
Cetyl alcohol
Chlordane
m-,o-, and p-chloroaniline
Chloroform
Chromium oxide
Citric acid
Copper hydrate
Cresol
Crotonic acid

Decyl alcohol
Denatured alcohol
Diacetone alcohol
Diallylamine
Dibenzyl sebacate
2,6-Di-tert-butyl-p-cresol
Dibutyl fumarate
Dibutyl maleate
Dibutyl phthalate
Dibutyl sebacate
Dibutylamine
Dicapryl phthalate
3,4-Dichloroaniline
o or p-Dichlorobenzene
2,2-Dichloroethyl ether
Dicyclohexyl phthalate
Dieldrin
Diethanolamine
Diethanolamine lauryl sulfate
Diethyl carbonate
Diethyl ethanolamine
Diethyl phthalate
Diethyl sulfate
N,N-Diethyl-m-toluidine
Diethylamine
N,N-Diethylaniline
Diethylbenzene
Diethylene glycol
Diethylene glycol monobutyl ether
Diethylene glycol monobutyl ether acetate
Diethylene glycol monoethyl ether
Diethylenetriamine
Di-isobutyl ketone
Di-isobutyl phthalate
Di-isobutylene
Di-isodecyl phthalate

Table 10 (continued)

Di-iso-octyl phthalate
Di-isopropanolamine
Di-isopropylamine
Dimethyl ethanolamine
Dimethyl sebacate
N,N-Dimethylaniline
2,4-Dinitrochlorobenzene
Dioctyl adipate
Dioctyl phthalate
Dioctyl sebacate
1,4-Dioxane
Dipentaerythritol
Dipropylene glycol
Dipropylene glycol monomethyl ether
Di-o-tolythiourea
Ditridecyl phthalate
Dodecenyl succinic anhydride
Dodecylphenol

Epichlorohydrin
Ethyl acetate
Ethyl acetoacetate
Ethyl acrylate
Ethyl alcohol
Ethyl amyl ketone
Ethyl bromide
Ethyl ethanolamines
2-Ethyl hexoic acid
2-Ethylhexyl acrylate
2-Ethylhexyl alcohol
Ethyl silicate
N-Ethyl-m-toluidine
N-Ethylaniline
Ethylene
Ethylene dichloride
Ethylene glycol
Ethylene glycol monobutyl ether
Ethylene glycol monoethyl ether
Ethylene glycol monoethyl ether acetate
Ethylene glycol monomethyl ether
Ethylene oxide
Ethylenediamine

Ferric stearate
Formaldehyde
Fumaric acid
Furfural
Furfuryl alcohol
Fusel oil

Gelatin, edible
Glue
Glycerine
Grease

Heptachlor
Hexylene glycol
Hydroabietyl alcohol
Hydrofluoric acid
Hydrogen peroxide
Hydroquinone

Isobutyl alcohol
Isobutyraldehyde
Isobutyric acid
Isobutyronitrile
Iso-octyl alcohol
Iso-octyl isodecyl phthalate
Isophorone
Isopropyl acetate
Isopropyl alcohol
Isopropyl ether

Lead, white
Lithium chloride
Lithium hydroxide
Lithopone

Magnesium lauryl sulfate
Malic acid
Manganese metal
Mesityl oxide
Methanol
Methionine hydroxyanalogue
Methyl abietate
Methyl acetone
Methyl acrylate
Methyl amyl acetate
Methyl amyl alcohol
N-Methylaniline
Methyl cellulose
Methyl ethyl ketone
Methyl isoamyl ketone
Methyl isobutyl ketone
Methyl salicylate
Methylene chloride
Monoallylamine
Monobutylamine
Monoethanolamine
Monoethylamine
Monoisopropanolamine
Monoisopropylamine
Monopenthaerythritol
Morpholine

Table 10 (continued)

Neopentylglycol
m-,o-, or p-Nitroaniline
o-, or p-Nitroanisole
Nitrobenzene
o-Nitrochlorobenzene
Nitroethane
Nitromethane
p-Nitrophenol
1- and 2-Nitropropane
o-Nitrotoluene
Nonylphenol

1-Octanol
n-Octyl-decyl alcohol
n-Octyl n-decyl phthalate

Paraformaldehyde
Paraldehyde
Pelargonic acid
Pentaerythritol
Perchloroethylene
o, or p-phenetidine
Phenol
Phenothiazine
N-Phenyldiethanolamine
m-Phenylenediamine
b-Phenylethylamine
Piperazine
Potassium bromate
Potassium cyanide
Propionic acid
n-Propyl acetate
n-Propyl alcohol
n-Propylamine
n-Propylene dichloride
Propylene glycol
Propylene oxide

Salicylic acid
Sodium acetate
Sodium antimoniate
Sodium benzoate
Sodium cyanide
Sodium hydrosulfite
Sodium lauryl sulfate
Sodium peroxide
Sodium sulfate
Sodium trichloroacetate
Sodium formaldehyde
Sorbitol
Succinic acid
Succinic anhydride
Sucrose acetate isobutyrate
Sulfanilic acid

Tetraethyl orthosilicate
Tetrahydrofurfuryl alcohol
Titanium dioxide
Tobias acid
Toluene
m-,o-, or p-Toluidine
Triacetin
Triallylamine
Tributyl citrate
Trichlorobenzene
1,1,1-Trichloroethane
Trichloroethylene
Tricresyl phosphate
Tridecyl alcohol, mixed isomers
Triethanolamine
Triethanolamine lauryl sulfate
Triethylamine
Triethyl citrate
Triethyl phosphate
Triethylene glycol
Triethylenetetramine
Triisobutylene
Tri-isopropanolamine
Trimethylol propane
Tripentaerythritol
Tripropylene
Tripropylene glycol

Vinyl propionate monomer
Vinyltoluene

m-, or p-Xylene

Zinc hydrosulfite
Zinc oxide
Zinc sulfate

Table 11

SELECTED FREIGHT-EQUALIZED CHEMICALS
AND SOUTHEASTERN PRODUCTION POINTS

Aluminum hydroxide
- Mobile, Ala.

Aluminum sulfate
- Mobile, Ala.
- Jacksonville, Fla.
- Port St. Joe, Fla.
- Atlanta, Ga.
- East Point, Ga.
- Macon, Ga.
- Savannah, Ga.
- Acme, N. C.
- Plymouth, N. C.
- Chattanooga, Tenn.
- Counce, Tenn.
- Kingsport, Tenn.
- Georgetown, S. C.

Ammonia
- Cherokee, Ala.
- Ketona, Ala.
- Wilson Dam, Ala.
- Pensacola, Fla.
- Tampa, Fla.
- Augusta, Ga.
- Savannah, Ga.
- Tyner, Tenn.
- Woodstock, Tenn.

Ammonium phosphate
- Cherokee, Ala.
- Wilson Dam, Ala.
- Bartow, Fla.
- Bonnie, Fla.
- Nichols, Fla.
- Tampa, Fla.

Ammonium sulfide
- Cartersville, Ga.

Benzoyl chloride
- Chattanooga, Tenn.

Caprolactam monomer
- Hopewell, Va.

Carbon disulfide
- Le Moyne, Ala.
- Lowland, Tenn.
- Old Hickory, Tenn.

Chlorine and caustic soda
- Anniston, Ala.
- Huntsville, Ala.
- McIntosh, Ala.
- Muscle Shoals, Ala.
- Brunswick, Ga.
- Acme, N. C.
- Canton, N. C.
- Pisgah, N. C.
- Plymouth, N. C.
- Charleston, Tenn.
- Memphis, Tenn.

Cresols
- Woodward, Ala.

Dimethylamine
- Pace, Fla.

Hydrochloric acid
- Anniston, Ala.
- McIntosh, Ala.
- Albany, Ga.
- Brunswick, Ga.
- Cartersville, Ga.
- Chattanooga, Tenn.
- Newport, Tenn.

Methyl methacrylate, monomer
- Knoxville, Tenn.

Methylamine, mono
- Pace, Fla.

Naphthalene
- Birmingham, Ala.
- Fairfield, Ala.
- Gadsden, Ala.
- Tarrant, Ala.
- Thomas, Ala.
- Woodward, Ala.
- Alton Park, Tenn.

Pyridine
- High Point, N. C.

Sodium phosphates
- Augusta, Ga.
- Charleston, S. C.

Table 11 (continued)

Sodium silicofluoride
Montgomery, Ala.
Agricola, Fla.
Mulberry, Fla.
Pensacola, Fla.
Tampa, Fla.
Savannah, Ga.
Greensboro, N. C.
Charleston, S. C.

Sodium sulfide
Cartersville, Ga.

Sulfur dioxide
Copperhill, Tenn.

Trimethylamine
Pace, Fla.

products that appear to be economically important. Of this number, only 18 are presently in production.

In 1960, clays and stone accounted for about 84% of an output valued at $86,262,000. Georgia was first in the nation in output of kaolin, marble, and crude iron oxide pigments; second in fuller's earth output; third in barite and mica production; and fourth in feldspar output.

Minerals in Current Production

Barite. Barite has been mined in north Georgia for over 100 years. Four producers in the Cartersville mining district (Bartow County), the center of the state's output, mined an estimated 79,000 tons of "heavy spar" in 1960. Analyses of Cartersville barite show about 97% $BaSO_4$. The future of barite production in Georgia will depend upon successful exploration of known barite prospects in six counties surrounding the Cartersville district.

Bauxite. Floyd County was the site of the first bauxite mine in the United States. Production in Georgia has never been large and because of the ore's high silica content (up to 8%) and low iron content (less than 3%), it has been used almost entirely in the chemical industry. In 1960, American Cyanamid Company was the only Georgia producer, with mines in Floyd, Macon, and Sumter counties. The combined Georgia-Alabama output of bauxite in 1960 amounted to only 66,000 long tons (dry equivalent).

In the Andersonville district of south Georgia, an estimated six million long tons of bauxite is reported to exist under economical mining conditions. Analysis reveals that it consists of over 51% Al_2O_3, 3% to 22% SiO_2, and 0.3% to 3% Fe_2O_3. Some 25 million tons of associated kaolin show over 37% Al_2O_3 and less than 2% quartz sand.

Portland Cement. The Marquette Cement Manufacturing Company of Chicago operates a mill in Polk County using local Rockmart (Ordovician) slate and Conasauga (Cambrian) limestone. A second mill in Houston County, operated by the Penn-Dixie Cement Corporation of Nazareth, Pennsylvania, uses limestone and fuller's earth from the Ocala (Eocene) formation and a Cretaceous clay. The combined rated annual capacity of the mills is 3,622,000 barrels. Two new mills are projected for locations near Albany and Atlanta.

Chattooga, Walker, and Dade counties in northwest Georgia are known to have suitable cement raw materials in proximity to each other. Limestones of probable cement grade are reported from Washington, Burke, and Screven counties in east-central Georgia, but the limestones in southwest Georgia near Albany appear to offer the most promise for further utilization.

Clays, Miscellaneous. Clays adaptable to heavy wares manufacture have been extensively mined in the Rome area (Floyd County). Alluvial clays are especially common along the Fall Line, where deposits reach depths of 15 feet, and in the Atlanta area. In 1959 there were 46 clay-working plants in the state using more than 1 1/4 million tons of clay. Principal plants are at Atlanta, Augusta, Campania, Columbus, Macon, Milledgeville, Plainville, and Thomasville.

Coal. Bituminous coal occurs over a 200-square-mile area in northwest Georgia. Present production comes from Walker County. Since 1932 annual output has seldom exceeded 40,000 tons.

Feldspar and Glass Sands. Feldspar occurrence is reported in at least 54 counties of the Piedmont and Blue Ridge regions of Georgia, but production has been almost entirely from the operations of the Appalachian Minerals Company in Jasper County. Because of a high percentage of potassium (more than 10% K_2O) and the quality of the finished product, it is well suited for the manufacture of chemical glassware and high temperature enamels.

The Libby Glass Division of Owens-Illinois Glass Company in Atlanta uses from 300 to 350 tons of glass sand daily, supplied from the Thomas County operation of the Dawes Silica Mining Company. Other potential glass sand deposits are known in Crawford, Bibb, and Jefferson counties. Over a million tons of sand for high quality glasses are estimated to be available near Mathews in Jefferson County.

Fuller's Earth. Georgia produced 93,689 short tons of fuller's earth valued at $1,777,051 in 1960. The six producers in the state are located in Grady and Thomas counties in southwest Georgia and in Bibb and Jefferson counties near the Fall Line. Apparent deposits are so large relative to present use that no reported attempt has been made to determine the extent of reserves. Results of physical tests on a typical fuller's earth sample from Georgia are shown on the next page.

Data	Fine Grade (Contacting)	Coarse Grade (Percolation)
Volatile matter (%)	16.0	16.5
Density (lb./cu. ft.)	31.0	35.0
Acidity (mg KOH per gram)	Neutral	Neutral
Screen test (% through 200-mesh)	95.0	--
Mineral-oil decclorization value (%) (efficiency a = 100%)	100.0	--

Iron Ore. Georgia has been a producer of iron ores since 1840. Production has been mainly brown ores, but some hematite and magnetite have also been mined. In recent years, production has been cut back from 423,000 long tons in 1957 to 128,000 long tons in 1960.

Until recently, iron ore production was confined to the northwestern section of the state. Production of the Coastal Plain brown iron ores, principally from Stewart and Webster counties, began in 1956. This southwestern area produced most of the state's output in 1960. The better ores in this area range from 54% to 58% metallic iron. Private capital recently engaged in drill prospecting the southwest Georgia ore areas, but the results are not known.

Iron Oxide Pigments. Commercial ochre deposits in Georgia are confined to the Cartersville mining district (Bartow County). The New Riverside Ochre Company was one of ten companies in seven states which produced crude iron oxide pigments in 1960. The company also produces finished pigments.

Kaolin. Kaolin is Georgia's principal mineral resource at present, and Georgia is the chief supplier of kaolin in the United States. Approximately 75% of the national kaolin production comes from the Fall Line counties of Georgia in a belt running northeast from Columbus to Augusta. Production is concentrated at present in Twiggs, Washington, and Wilkinson counties, with some tonnages mined in Baldwin, Glascock, Hancock, and Richmond counties.

Indirect estimates indicate that the state's known reserves of paper-grade kaolins are in excess of 100 million tons. This does not include the 25 million tons of non-paper-grade kaolin, containing 37% alumina, in the Andersonville area. (See section on Bauxite.)

Georgia produced 2,121,237 short tons of kaolin in 1960. Prices covered a considerable range, with the highest average price charged for organic plastics fillers being $23.59 per short ton. Rubber fillers were priced at $13.73 per ton. Prices for kaolin used by the chemical industry were at the lower end of the range.

Limestone and Marble. Limestone occurs in each geologic area of the state, but known commercial formations are found only in the northwestern and southwestern corners. Principal marble deposits are quarried in the Murphy Marble Belt of north Georgia. Both minerals are used primarily for construction purposes, but some finely ground materials are used as fillers in chemical products and as agricultural lime. No chemical lime plants are currently in operation.

Analyses of Georgia limestone indicate that portions of both of the commercial formations produce chemical-grade limestones; MgO content is less than 0.5%. Chemical-grade limestones may underlie other areas of the Coastal Plain of Georgia, but the latest study of that area was published in 1916. Another potential commercial source is the beds of oyster shells near the coast.

Several studies are in progress to determine the advisability of establishing a chemical lime plant in Georgia.

Manganese Ore. Manganese ore has been mined in Bartow County since 1866. Notable outputs have also come from Floyd, Haralson, Murray, Paulding, Polk, and Whitfield counties. Production has been erratic and in recent years has occurred only under the stimuli of war or subsidy.

Mica. Hart, Pickens, and Upson counties have been major producers of full-trimmed mica, and Cherokee County produces sericite mica for grinding. In 1959 some 20 companies or individuals were engaged in producing both types of mica. In that year the sheet mica output totaled 10,200 pounds, valued at $119,000.

Peat. Peat produced in Georgia is used for horticultural purposes rather than for fuel. Lowndes and Screven counties have been the chief sources of this material. Output in 1960 was 6,904 short tons, valued at $89,000.

Talc. Murray County is the source of most of the talc presently mined in the state. Talc of several grades, some of which have been indicated as

suitable for cosmetic use, has been produced. Some 40,200 short tons, valued at $88,000, were produced in 1960.

Minerals of Potential Value

Asbestos. Although known deposits of asbestos are practically depleted today, past production has occurred in Fulton, Habersham, Meriwether, Rabun, and White counties.

Beryl. Cherokee, Morgan, Pickens, and Troup counties have reported production of beryl in the past, but most of this output has been a by-product of mica mining. Both aquamarine and yellow types occur.

Copper, Gold, Lead, Pyrite, and Zinc. Each of these minerals was mined both individually and in association with the others prior to World War I. In fact, before the California gold rush, Georgia was the nation's foremost gold-producing state. Known occurrences are all within the Crystalline geologic area.

Heavy Minerals. Heavy minerals, including the ores of cerium, hafnium, thorium, titanium, and zirconium, are found widely disseminated in the sediments of the Coastal Plain. Concentrations of heavy-mineral-bearing sands are commonly found along the entire Georgia coast and are also found in inland terraces from 20 to 100 miles west of the coast. None of the presently known deposits can be mined without consideration of all the heavy minerals present.

Concentrations which have been especially noted by geologists include the titanium-bearing sands near the southern ends of St. Simons and Sapelo islands, deposits in the vicinity of Aiken, South Carolina, in which monazite reportedly may be the primary mineral, and a few places along the eastern margin of the Okefenokee Swamp where concentrations of up to 1% of heavy minerals have been found in the topmost several feet of surface sediments.

Kyanite and Sillimanite. Although occurrences have been reported in 20 counties in the Crystalline area, neither kyanite nor sillimanite presently is being produced in Georgia; past production has come from Cherokee, Habersham, and Towns counties. In 1961, mineral rights to Graves Mountain in Lincoln County were acquired by Aluminum Silicates Corporation of Pennsylvania for the purpose of mining kyanite.

Petroleum and Natural Gas. Neither oil nor gas has been discovered in Georgia. Exploration is in progress in the Coastal Plain, particularly in the coastal counties, and the possibility is considered good that oil and/or gas deposits will eventually be found.

Tripoli. Tripoli, often called "rotten stone" or "soft silica," occurs in several northwest Georgia counties and has been mined in Chattooga and Whitfield counties.

Minerals of Uncertain Value

Limited occurrences of chromite, corundum, gem minerals, graphite, marls, and tungsten are unexplored. Of these, corundum and graphite have been commercially produced in the state. The Laurel Creek mine near Pine Mountain, where corundum was first discovered in the early 1870's, at one time was the most famous corundum mine in the country and is still considered to offer the best possibilities for mining in the state. Although no marls have been commercially mined, they are widely distributed throughout the Coastal Plain. Their value for use in fertilizer has never been thoroughly investigated.

Forest Resources

A considerable portion of Georgia's industry is based on forest products. Most notable is the pulp and paper industry, whose value added by manufacture in 1958 exceeded $228 million. Within the state's chemical industry, gum and wood chemicals traditionally have led in value added by manufacture.

This is not surprising since some 25.8 million acres, or 69% of the state's total land and water area, is commercial forest land. Pines comprise the major part of Georgia's forests, according to Table 12, which shows the volume of various species grown on commercial forest land in the state. Map 19 delineates the areas of the state within which selected species predominate.

Annual growth of the state's commercial forests in 1961 was estimated at 1,337.2 million cubic feet. Excess of growth over total drain (annual cut plus loss due to fire, insects and other natural causes) was estimated at 168 million cubic feet. A comparison of growth and removal statistics for 1961 is shown in Table 13.

Table 12

VOLUME OF SAW TIMBER AND GROWING STOCK ON COMMERCIAL FOREST LAND IN GEORGIA, BY SPECIES, 1960-1961

Species	Saw Timber (million board feet)	Growing Stock (million cubic feet)
Softwoods:		
Longleaf pine	3,717.5	1,169.0
Slash pine	7,124.6	2,402.2
Loblolly pine	10,707.6	3,549.1
Shortleaf pine	3,853.6	1,616.6
Other softwoods	2,978.7	1,002.3
Total Softwoods	28,382.0	9,739.2
Hardwoods:		
Gum	5,776.3	2,491.2
Other soft hardwoods	3,468.0	1,443.0
Oak	7,898.0	2,767.4
Other hard hardwoods	2,487.4	889.8
Total Hardwoods	19,629.7	7,591.4
All Species	48,011.7	17,330.6

Note: Standard of measurement of saw timber is the international 1/4-inch rule. Growing stock measurements exclude bark.

Source: Preliminary Forest Survey Statistics (Georgia series 1960-1961), Division of Forest Economics Research, Southeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, 1962.

Table 13

COMPARISON OF GROWTH AND REMOVAL OF GROWING STOCK ON COMMERCIAL FOREST LAND IN GEORGIA, 1961

(millions of cubic feet)

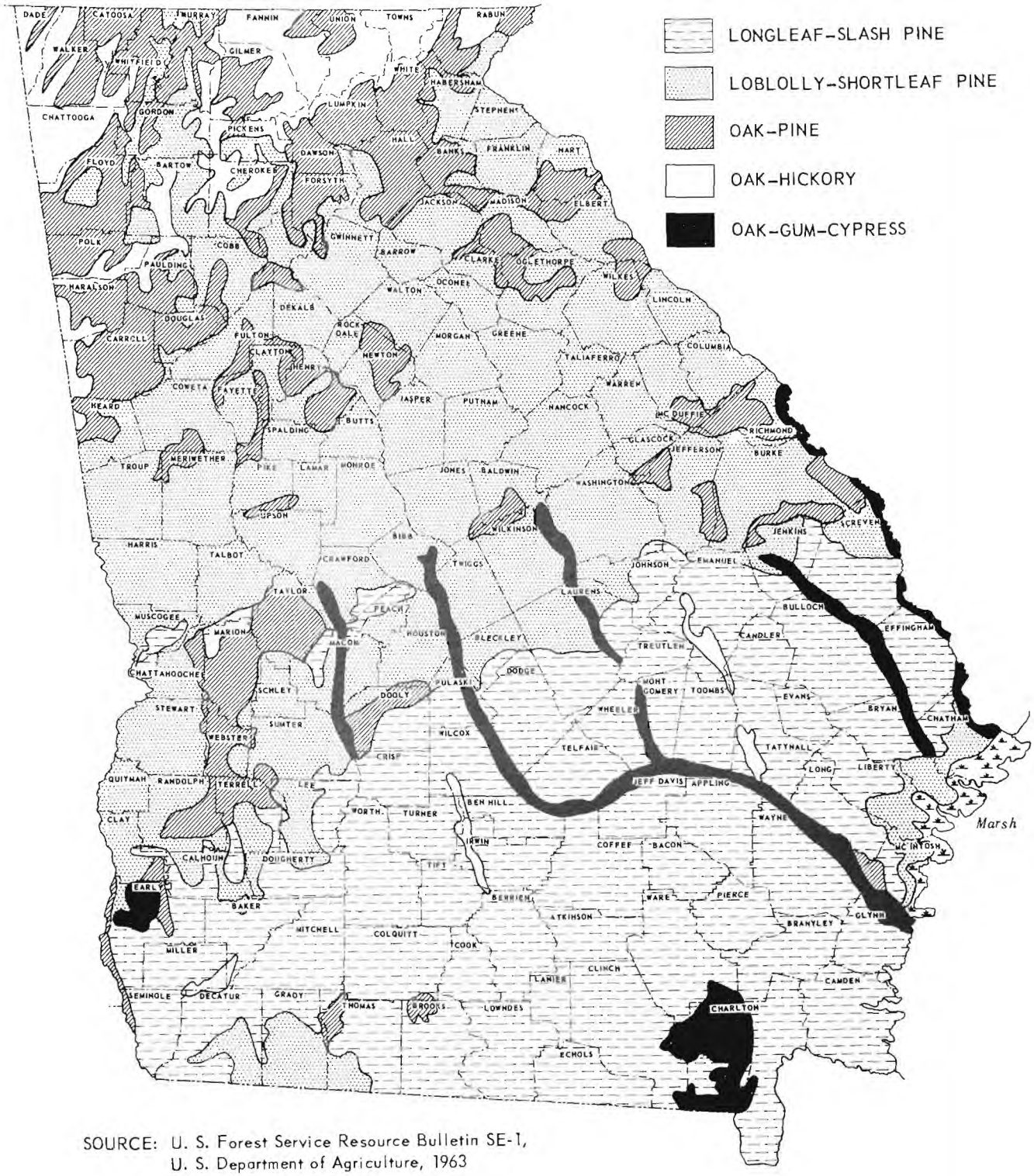
	Total Annual Growth	Annual Mortality	Annual Cut	Balance
Softwoods	909.9	101.4	715.6	92.9
Hardwoods	427.3	107.9	244.3	75.1
All Species	1,337.2	209.3	959.9	168.0

Note: "Annual Mortality" comprises losses due to fire, insects, diseases, wind, suppression, animals, and other natural causes.

Source: Preliminary Forest Survey Statistics (Georgia series (1960-1961).

MAP 19

MAJOR FOREST TYPES IN GEORGIA



SOURCE: U. S. Forest Service Resource Bulletin SE-1,
U. S. Department of Agriculture, 1963

Pulp companies owned 3,153,100 acres of commercial forest land in 1961. Other ownership was as follows:

Public	1,840,900 acres
Wood-using industries, excluding pulp companies	793,300 acres
Farmers	15,052,300 acres
Miscellaneous private owners	4,932,600 acres

Georgia mills contributed about 10% of the nation's pulp capacity in 1958. Combined production of both dissolving and paper-grade pulp is expected to increase from 2,138,800 tons in 1958 to 3,439,000 tons by 1975. A continuation of the increase in paper and board (excluding building paper) production is also anticipated. The volume should reach 2,819,000 tons in 1975, in contrast with 1,749,200 tons in 1958.

In addition to providing a market for chemicals, Georgia's pulp and paper industry produces useful chemical raw materials, such as chemical cellulose and the by-products, sulfate turpentine and tall oil. Rayonier, Inc., at Jesup, produces about 200,000 tons of alpha cellulose (up to 98.5% pure) each year.

In 1962, nine Georgia pulp mills produced an estimated 5.3 million gallons of sulfate turpentine and 115,000 tons of crude tall oil. In addition, millions of tons of by-product lignin would be available, if needed in large quantities as a chemical raw material. At present, kraft processing mills, which account for most of the state's pulp production, burn this by-product to produce steam, while recovering spent chemicals which are treated for reuse.

Long a leading state in naval stores production, Georgia contributed gum and wood chemical shipments valued at $55,568,000 to the total U. S. production of $182,176,000 in 1958. The figures include tall oil and tall oil products, as well as traditional naval stores, such as pine oil, rosin, gum and wood turpentine, charcoal, and natural tanning materials.

Hercules Powder Company operates the world's largest naval stores plant at Brunswick. Its continual expansion is due in part to research efforts directed toward diversification of products based on naval stores. It would be difficult to produce a more positive testimonial in behalf of the value of naval stores as a chemical raw material.

GEORGIA'S WATER RESOURCES[1/]

Georgia has an abundance of water. About 17 inches of annual runoff, over an area of 58,518 square miles, go directly into surface streams or enter aquifers. Annual rainfall varies from a high of 70 inches in the 5,000-foot elevations of the Blue Ridge province in north Georgia to a low of 43 inches in south central Georgia. The state as a whole averages 50 inches.

Reliable sources of water may be found in any part of the state. High rainfall in the Blue Ridge province, where the streams are comparatively small and an artesian aquifer is lacking, assures steady flow in the streams and a high water table in the valleys. By the time the rivers reach the Piedmont they are of considerable size and are the main source of water. On the Coastal Plain, with potable water a few hundred feet beneath the surface at the most, industry and municipalities depend on wells as a source of water and on the streams for disposal. Georgia seaport locations are particularly fortunate in being able to pump from the ground millions of gallons of pure water daily, in contrast with other coastal locations which must depend on surface streams, frequently polluted upstream.

Surface Water

Quantity and Quality

Georgia's five major river systems -- the Coosa, Chattahoochee, Flint, Savannah, and Altamaha -- along with several smaller rivers, discharge 39 billion gallons of water a day. The state's topography causes most of the rivers to flow toward the south or southeast, either into the Gulf of Mexico or the Atlantic Ocean.

Differences in rainfall and physiographic factors cause great variations in quantity and quality of surface water resources throughout the state. The numbers on Map 20 refer to stations for which information on flow, chemical characteristics, and temperature is presented in Tables 14, 15, and 16.

1/ For additional information, see Summary of the Water Resources in Georgia, compiled by George I. Whitlatch, to be published early in 1964 by Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia.

MAP 20

MAJOR RIVER SYSTEMS IN GEORGIA

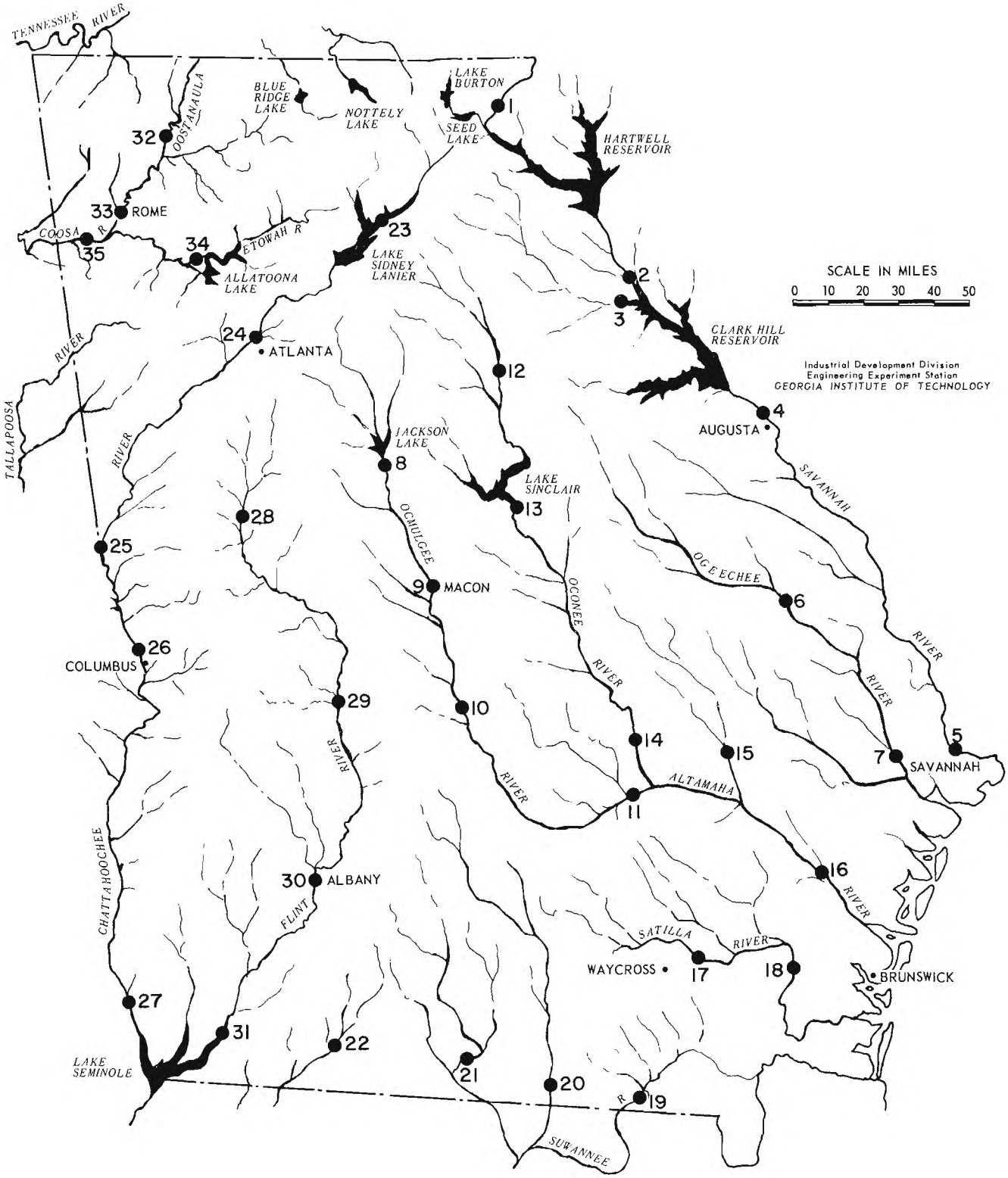


Table 14

FLOW RECORDS OF GEORGIA RIVERS

(in millions of gallons per day)

Gauging Station	Drainage Area (sq. mi.)	Period of Record	Average Flow	Minimum Flow	Date
SAVANNAH RIVER BASIN					
1. Chattooga River near Clayton	207	1907-08; 1939-55	386	57	Oct. 1954
2. Savannah River near Iva, S. C.	2,231	1950-55	2,450	349	Oct. 1954
3. Broad River near Bell	1,430	1926-32; 1937-55	1,100	71	Oct. 1954
4. Savannah River at Augusta	7,508	1884-91; 1898-1906; 1925-55	6,720	672	Oct. 1927
5. Savannah River near Clyo	9,850	1937-55	7,140	1,830	Oct. 1941
OGEECHEE RIVER BASIN					
6. Ogeechee River at Scarboro	1,940	1937-55	1,040	78	Sept. 1954
7. Ogeechee River near Eden	2,650	1937-55	1,370	85	Sept. 1954
ALTAMAHA RIVER BASIN					
8. Ocmulgee River near Jackson	1,420	1906-15; 1939-55	1,120	45	Nov. 1954
9. Ocmulgee River at Macon	2,240	1893-1913; 1931-55	1,750	83	Oct. 1954
10. Ocmulgee River at Hawkinsville	3,800	1944-55	2,540	271	Oct. 1954
11. Ocmulgee River at Lumber City	5,180	1936-55	3,460	522	Oct., Nov. 1954
12. Oconee River near Greensboro	1,090	1903-31; 1937-55	874	38	Oct. 1954
13. Oconee River at Milledgeville	2,950	1903-23; 1937-55	2,180	58	Aug. 1925; Apr. 1955
14. Oconee River near Mt. Vernon	5,110	1937-55	3,220	304	Oct. 1954
15. Ohoopee River near Reidsville	1,110	1903-07; 1937-55	586	12	Sept. 1954
16. Altamaha River at Doctortown	13,600	1931-55	8,170	924	Oct., Nov. 1954
SATILLA RIVER BASIN					
17. Satilla River near Waycross	1,300	1937-55	564	4.0	Nov. 1954
18. Satilla River at Atkinson	2,880	1931-55	1,290	2.9	Nov. 1931
SUWANNEE RIVER BASIN					
19. Suwannee River at Fargo	1,260	1921-23; 1927-31; 1937-55	698	0	1931, 1943, 1954
20. Alapaha River at Statenville	1,400	1921; 1931-55	599	11	Nov. 1954
21. Withlacoochee River near Quitman	1,560	1920-21; 1928-31; 1937-48	786	4.4	Nov., Dec. 1940; Dec. 1941
OCHLOCKONEE RIVER BASIN					
22. Ochlockonee River near Thomasville	550	1937-55	287	1.7	Oct. 1938
APALACHICOLA RIVER BASIN					
23. Chattahoochee River near Gainesville	559	1901-03; 1937-55	753	134	Oct. 1954
24. Chattahoochee River at Atlanta	1,450	1928-31; 1936-55	1,640	220	Oct. 1954
25. Chattahoochee River at West Point	3,550	1896-1910; 1912-55	3,630	145	Sept. 1925
26. Chattahoochee River at Columbus	4,670	1912; 1929-55	4,190	310	Oct. 1931
27. Chattahoochee River at Hilton	8,040	1928-55	6,960	782	Oct. 1954
28. Flint River near Molena	990	1898; 1945-53	876	33	Sept. 1951
29. Flint River at Montezuma	2,900	1905-09; 1911-12; 1930-33; 1934-55	2,310	378	Oct. 1941
30. Flint River at Albany	5,230	1902-21; 1929-55	4,060	275	Aug. 1930
31. Flint River at Bainbridge	7,350	1908-13; 1928-55	5,420	1,230	Dec. 1955
MOBILE RIVER BASIN					
32. Conasauga River at Tilton	682	1937-55	734	44	Oct. 1954
33. Oostanaula River near Rome	2,120	1939-55	2,220	264	Oct. 1954
34. Etowah River at Allatoona Dam above Cartersville	1,110	1938-55	1,093	134	May 1953
35. Coosa River near Rome	4,040	1897-1903; 1928-31; 1937-55	4,250	562	Oct. 1931; Sept. 1955

Source: Georgia Geological Survey Bulletin No. 65

Table 15

CHEMICAL ANALYSES OF SELECTED SURFACE WATERS
(Chemical constituents in parts per million)

Gauging Station	Date of Collection	Discharge (mgd)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (sum)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH	Color
SAVANNAH RIVER BASIN																			
1. Chattooga River near Clayton	1- 1-58	787	5.7	-	0.8	0.7	1.1	0.2	5	0.2	0.5	0.1	0.0	12	5	1	12.0	6.6	5
	6- 2-58	736	7.5	0.12	1.2	.1	1.0	.5	8	.8	1.5	.0	.0	17	4	0	13.1	6.5	3
2. Savannah River near Iva, S. C.	5- 1-58	9,450	9.2	.21	1.4	.7	2.5	.8	13	2.0	2.0	.1	.4	26	6	0	25.7	6.7	12
3. Broad River near Bell	1-21-58	1,140	19	-	4.0	1.6	4.7	1.3	27	2.8	3.2	.0	.3	50	16	0	57.4	6.6	25
4. Savannah River near Augusta	6- 3-58	7,700	11	.21	2.8	1.3	4.5	1.4	21	3.5	4.5	.1	.6	40	12	0	47.2	6.9	17
5. Savannah River at Clyo	6- 3-58	7,600	11	.61	5.2	1.2	4.0	1.0	26	4.0	3.2	.1	.3	43	18	0	56.6	6.7	8
OGEECHEE RIVER BASIN																			
6. Ogeechee River at Scarboro	1- 2-58	2,770	12	-	7.2	.4	3.5	.8	24	1.8	5.0	.1	.0	43	20	0	54.5	6.7	42
	5-31-58	905	13	.26	10	1.3	3.2	.6	40	2.2	4.2	.1	.5	55	30	0	77.0	6.7	38
7. Ogeechee River at Eden	1- 2-58	3,600	12	-	7.6	.9	3.6	.7	27	1.8	5.0	.2	.0	45	22	0	59.4	6.9	65
	5-31-58	1,500	12	1.5	9.2	1.0	3.5	.7	35	2.2	4.8	.1	.2	51	27	0	69.8	6.6	35
ALTAMAHA RIVER BASIN																			
8. Ocmulgee River near Jackson	12- 4-57	3,120	11	-	6.0	.7	3.4	2.4	26	3.5	3.0	.1	.4	44	18	0	58.3	6.6	-
	5-28-58	1,210	11	.44	3.6	1.0	4.2	1.5	23	2.8	3.5	.2	.5	39	13	0	52.8	6.5	3
9. Ocmulgee River at Macon	12- 5-57	4,120	12	-	2.0	1.9	3.9	2.3	18	3.5	3.0	.1	.7	38	13	0	47.3	6.6	-
	2-12-58	4,840	8.8	-	2.6	1.0	3.5	2.0	14	3.5	2.5	.1	1.6	32	10	0	42.3	6.0	-
	5-28-58	1,650	13	.33	3.8	1.3	4.8	1.4	24	3.5	2.8	.3	1.1	44	15	0	57.2	6.8	3
10. Ocmulgee River at Hawkinsville	12- 6-57	7,920	12	-	4.8	1.0	4.5	1.7	21	3.8	3.5	.1	.0	42	16	0	52.4	6.5	-
	5-28-58	2,250	13	.40	5.2	1.9	4.7	1.2	27	3.2	3.0	.3	1.3	47	21	0	66.3	6.9	7
11. Ocmulgee River near Lumber City	8- 8-57	3,400	12	-	11	1.5	4.5	1.2	46	3.5	3.8	.0	.4	61	34	0	93.3	6.9	7
	12- 6-57	15,000	11	-	4.4	.9	3.7	1.7	20	3.8	3.0	.1	.1	39	14	0	49.8	6.5	-
	5-28-58	5,900	12	.69	9.2	1.3	4.5	1.1	37	2.0	2.8	.3	1.1	52	28	0	78.1	7.1	12
12. Oconee River near Greensboro	12- 5-57	1,310	16	-	3.2	1.5	4.0	1.5	21	3.0	2.5	.3	.5	43	14	0	47.2	6.5	7
	5-28-58	885	17	.60	4.0	1.1	4.0	1.0	24	.8	3.0	.3	1.8	45	14	0	49.5	7.0	5
13. Oconee River at Milledgeville	12- 5-57	7,170	13	-	3.2	1.5	3.3	1.8	21	2.8	2.2	.2	.1	38	13	0	44.7	6.5	-
	5-28-58	976	13	.35	3.6	1.5	3.4	1.4	24	2.8	3.0	.1	.6	41	15	0	48.5	6.7	22
14. Oconee River near Mt. Vernon	12- 6-57	13,500	14	-	4.0	1.2	3.4	1.7	21	3.5	3.5	.2	.3	42	15	0	47.7	6.6	-
	5-29-58	3,400	13	.66	7.4	1.3	3.7	1.1	34	3.2	3.8	.2	.6	51	24	0	69.6	6.8	3
15. Ohoopee River near Reidsville	3-12-58	8,140	7.3	-	1.8	.5	2.8	.8	6	1.2	3.2	.1	.3	21	6	2	25.7	5.7	47
	5-29-58	392	11	.83	3.4	.5	2.7	.6	13	1.0	5.5	.1	.3	32	10	0	36.0	6.5	45
16. Altamaha River at Doctortown	12- 6-57	32,700	13	-	3.8	1.2	6.0	1.6	18	5.5	5.5	.2	.1	46	14	0	56.3	6.6	-
	3-14-58	51,700	7.5	-	3.6	.4	3.1	1.2	14	1.8	3.0	.1	1.3	29	10	0	37.9	6.4	40
	5-29-58	12,600	12	.70	7.6	1.5	4.2	.9	35	.5	3.8	.2	.3	48	25	0	69.7	6.9	27

Table 15 (continued)

Gauging Station	Date of Collection	Discharge (mgd)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (sum)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific conductance (micromhos at 25°C)	pH	Color
SATILLA RIVER BASIN																			
17. Satilla River near Waycross	1- 9-58	1,830	12	-	1.4	1.7	4.9	.6	5	.0	8.0	.2	.3	32	10	6	41.9	5.3	55
18. Satilla River at Atkinson	5-19-58	1,260	7.3	.95	1.6	.4	3.6	.4	0	.8	6.8	.4	.5	22	6	6	34.0	4.5	150
SUWANNEE RIVER BASIN																			
19. Suwannee River at Fargo	1-14-58	905	4.3	-	1.2	.9	4.3	.7	0	2.8	9.8	.1	.3	25	6	6	58.8	4.4	180
	5-28-58	785	1.8	.02	1.4	.5	4.0	.2	0	.5	7.2	.6	.4	17	6	6	59.7	4.3	400
20. Alapaha River at Statenville	11- 7-57	165	10	-	1.6	1.0	3.4	.6	6	2.5	6.5	.1	.4	29	8	3	35.8	6.1	55
	5-28-58	2,500	5.8	1.1	1.2	.6	2.8	.4	4	1.8	3.8	.6	.8	20	6	2	27.3	5.4	150
21. Withlacoochee River near Quitman	12-11-57		8.1	-	1.2	1.0	4.1	.7	6	1.8	7.0	.3	.0	28	7	2	39.7	5.6	130
	5-20-58		7.6	1.1	1.6	1.1	4.3	.6	6	2.2	6.0	.5	.8	28	8	4	39.2	6.0	150
OCHLOCKONEE RIVER BASIN																			
22. Ochlockonee River near Thomasville	11- 9-57	98	13	-	4.0	1.9	11	1.4	20	2.8	15	.0	.3	60	18	2	94.9	6.1	90
	11-25-57	1,630	8.7	-	1.8	1.3	4.2	1.0	8	2.0	7.8	.2	.1	32	10	4	46.0	5.9	150
	5-21-58	640	7.7	1.2	2.6	1.5	4.6	.6	14	2.5	6.8	.4	.9	34	12	1	47.6	6.5	100
APALACHICOLA RIVER BASIN																			
23. Chattahoochee River near Gainesville	4- 8-58		7.9	-	2.0	.6	1.8	1.2	19	.2	1.3	.0	.5	25	8	0	28.5	7.4	12
	5-24-58		6.6	.11	1.4	.9	1.6	1.0	12	.2	.8	.1	.0	19	7	0	23.8	6.6	7
24. Chattahoochee River at Atlanta	4- 8-58	1,380	8.4	-	2.6	1.5	2.8	1.3	23	1.5	2.0	.1	.4	33	12	0	42.2	7.3	25
	5-25-58	750	7.1	.04	3.2	1.1	2.6	1.4	18	1.2	1.5	.0	.9	28	12	0	40.7	6.8	3
	5-25-58		12	.38	10	2.4	15	3.9	79	10	17	.1	.1	110	35	0	210	6.7	12
	5-25-58		9.6	.42	5.6	1.2	5.5	2.1	21	5.2	4.8	.1	4.9	49	19	2	72.1	6.9	3
25. Chattahoochee River at West Point	4-10-58	6,640	13	-	3.0	1.6	3.3	1.2	24	2.2	3.0	.1	.5	40	14	0	46.9	7.3	7
	5-26-58	3,360	13	.23	4.2	1.6	5.9	1.2	24	5.0	4.2	.3	1.4	49	17	0	66.4	6.7	3
26. Chattahoochee River at Columbus	4-10-58	9,150	12	-	2.4	1.5	4.0	1.3	22	2.8	.8	.1	.7	37	12	0	46.8	7.1	14
	5-26-58	3,370	12	.06	3.8	1.6	5.9	1.1	25	3.5	3.8	.2	1.1	45	16	0	59.7	7.1	3
27. Chattahoochee River near Hilton	4-10-58	20,500	8.4	-	4.4	.9	2.9	.8	18	3.5	2.2	.0	.7	33	14	0	45.8	6.6	17
	5-27-58	5,500	11	.15	5.8	1.3	5.2	.9	28	4.0	3.0	.2	.3	46	20	0	66.2	6.9	3
28. Flint River near Molena	10-11-57		16	-	3.6	1.0	4.4	1.8	22	1.8	3.5	.0	.4	44	13	0	51.3	6.7	16
	5-25-58		15	1.0	4.0	1.7	4.2	1.1	26	.8	2.5	.5	.6	43	17	0	53.7	6.5	13
29. Flint River at Montezuma	10-11-57	2,110	13	-	2.2	1.0	4.3	1.2	18	1.8	2.8	.0	.4	36	10	0	41.1	6.5	13
	5-25-58	2,290	12	.96	2.8	1.2	4.3	.8	20	.5	2.5	.3	.5	35	12	0	45.2	6.4	7
30. Flint River at Albany	10-12-57	4,240	11	-	6.4	.4	3.4	1.1	23	2.5	3.5	.4	.3	40	18	0	55.6	6.6	17
	5-26-58	4,090	10	.07	13	.4	3.1	.7	38	2.0	3.0	2.9	.0	54	34	3	86.7	6.8	3
31. Flint River at Bainbridge	10-12-57	22,000	9.8	-	21	3.8	2.8	.9	84	2.2	3.8	.0	.5	86	68	0	142	7.4	16
	11-25-57	23,600	11	-	7.6	1.0	3.9	1.1	32	1.8	3.5	.2	.2	47	23	0	62.4	7.7	-
MOBILE RIVER BASIN																			
32. Conasauga River at Tilton	5-24-58	636	7.7	.02	15	4.0	6.2	.9	68	3.0	8.0	.1	.6	78	54	0	135	7.3	3
33. Oostanaula River at Rome	5-24-58	2,560	8.4	.01	11	2.6	5.4	.9	45	9.0	3.8	.1	.5	64	38	1	104	7.0	4
34. Etowah River at Dougherty[1/]	5-23-58		9.7	.03	1.0	.5	1.6	1.2	10	.2	1.0	.1	.0	20	4	0	17.9	6.7	7
35. Coosa River near Rome	5-24-58		9.4	.02	9.8	3.0	3.4	2.1	46	4.2	3.0	.1	.4	58	37	0	90.0	6.9	4

1/ Dougherty is about 80 miles upstream from Allatoona Dam, the location indicated by the number 34 on map 20. Data for the Etowah River at Allatoona Dam above Cartersville were not available.

Source: Georgia Geological Survey Bulletin 69

Flow information in Table 14 requires some comment. In the severe drought year of 1954, gauging stations on all of Georgia's rivers reported the lowest minimum flows on record. Total rainfall in that year was nearly 50 inches below the average, and runoff, most of which occurred in the spring months, amounted to only six inches. An occurrence of similar magnitude can be expected once every 13 to 30 years.

Table 16

TEMPERATURES OF GEORGIA RIVERS

Map Code	Location	Year	Annual Range	High Month	Low Month	Source
23-24	Chattahoochee below Buford Dam	1961	47 - 50°F	Aug.	March	1
24	Chattahoochee at Atlanta Intake Station	1961	45 - 64	July	Jan.	2
24-25	Chattahoochee at Whitesburg	1961	46 - 75	Aug.	Jan.	3
34	Etowah River near Cartersville (below Allatoona Dam)	1953	42 - 73	Sept.	Jan.	1
2	Savannah River below Hartwell Dam	1962	46 - 59	Oct.	Jan.	1
4	Savannah River below Clark Hill Dam	1962	51 - 68	Oct.	March	1

Sources: 1. U. S. Army Corps of Engineers, Atlanta office
2. City of Atlanta Water Works
3. Georgia Power Company, Plant Yates

However, several major reservoirs have been constructed since 1954, providing storage in excess of that required to maintain the average flow reported for the low year of 1954. Major impoundments include Buford Reservoir on the Chattahoochee River, Allatoona Reservoir on the Etowah River, Blue Ridge Reservoir on the Toccoa River, and Burton Reservoir on the Tallulah River. Other substantial reservoirs are Clark Hill on the Savannah River, Sinclair on the Oconee River, Jim Woodruff on the Appalachicola (at the junction of the Chattahoochee and Flint rivers), and Jackson on the Ocmulgee River. Under construction is Hartwell Reservoir on the upper Savannah River.

Pollution Control

Water quality control is administered by the Georgia State Board of Health, which is empowered by law to regulate the discharge of industrial wastes into surface waters. The Board is authorized to issue certificates of approval where necessary. The Board's actions are subject to review by the Georgia Water Quality Council, whose membership includes officials from State departments and citizens representing such economic interests as the textile, pulp, and food industries.

Ground Water

Quantity and Quality

Georgia has large, although unmeasured, ground water resources which occur in five distinct aquifers. (See Map 21.) The aquifer of the Valley and Ridge province and the three aquifers of the Coastal Plain province are the most productive in the state.

The principal artesian aquifer of the Coastal Plain is composed of limestone beds which are "among the nation's and perhaps the world's most productive aquifers."[1/] This single formation supplies over 70% of the ground water used in Georgia, including the municipal and industrial demands at Brunswick (90 million gallons a day in 1957), Jesup (45 mgd), St. Marys (26.6 mgd), and Savannah (60 mgd). In 1957, 90% of the Brunswick water was used by three industrial plants, Brunswick Pulp and Paper Company, Hercules Powder Company, and Solvay Process Division of Allied Chemical Corporation. Brunswick Pulp and Paper Company, with six wells producing 44.7 million gallons a day (an average of 5,170 gallons per minute per well), was the largest single user in the Coastal Plain area. Near Savannah, individual wells yield about 2,000 gallons per minute.

In the Cretaceous sand aquifer of the Coastal Plain, individual wells yield from 20 to 1,000 gallons per minute (gpm). Wells in the limestone-sand aquifer yield up to 2,000 gpm. Records show that during a year of extreme drought in the Southeast, the Coastal Plain continued to supply undiminished

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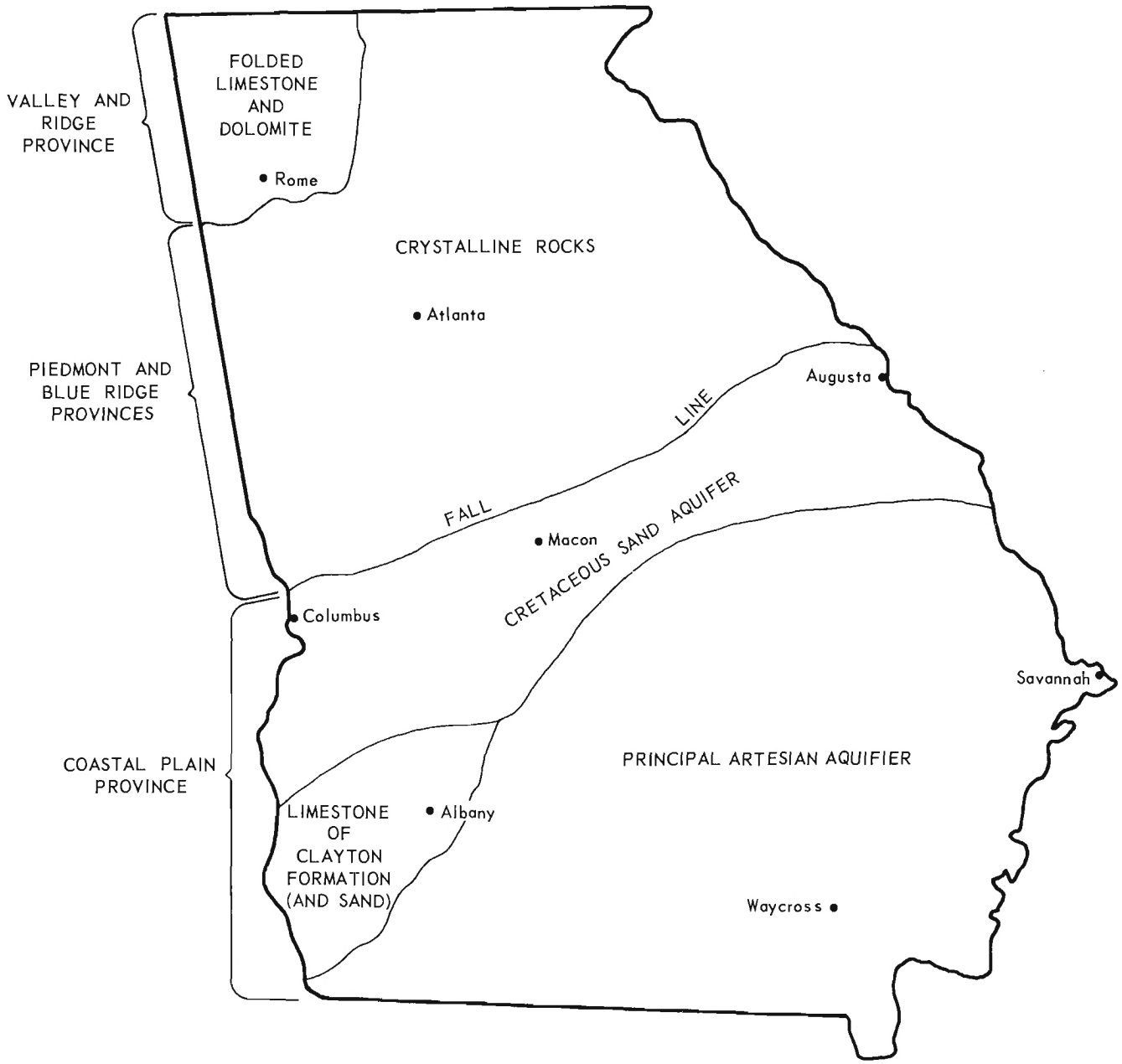
1/ Joseph T. Callahan, "Ground Water for Georgia's Expanding Economy," Georgia Mineral Newsletter, Winter 1960.

MAP 21

THE MAJOR AQUIFER AREAS OF GEORGIA



SOURCE: Adapted from Georgia Mineral Newsletter, Vol. X, No. 3.

quantities of ground water. Near the coast, wells which penetrate the principal artesian aquifer flow freely without pumping; in the vicinity of Brunswick and Savannah wells are pumped to increase the flow.

The Valley and Ridge province also has abundant ground water, although its reserves are not nearly as large as those of the Coastal Plain. Yields of 1,500 gpm are not uncommon in this province. Two springs in Walker County are recorded as producing 16,000 gpm each.

The Piedmont and Blue Ridge provinces, while well supplied with surface water, are not bountifully provided with ground water because the under-lying rocks are crystalline and relatively impermeable. Many wells have been drilled to yield 100 to 400 gallons per minute, but the locations for wells must be more carefully selected than in other areas of the state.

Ground water temperatures are consistent the year round, and quality is generally acceptable to the chemical industry. Table 17 is based on a limited number of well samples, but it gives an indication of the range of temperature and quality within each aquifer.

Well Development Costs

To illustrate the present costs of well development in the Coastal Plain section of south Georgia, the following selected examples are cited.1/

At Albany, a well producing approximately one million gallons a day from aquifers at depths of 600 to 800 feet would cost about $40,000, including pump and motor.

A recent installation at Douglas consisting of a deep-well turbine pump and motor, complete with housing, chlorinator, and pipeline connections to the distribution system, cost a total of $36,000. This well produces 1,250 gallons per minute (gpm) from a limestone aquifer at a depth of 723 feet.

In the kaolin-producing areas (Twiggs, Washington, and Wilkinson counties), recent installations of screened and gravel-packed wells producing 600 gpm from water-bearing sands at a 400-foot depth have cost an average of $15,000 per well, complete with pump and motor.

1/ Based upon data furnished through the courtesy of Mr. W. A. Martin, President, Virginia Supply and Well Company of Atlanta, Georgia.

Table 17

CHEMICAL CHARACTERISTICS OF GEORGIA GROUND WATERS

	Valley and Ridge Province	Piedmont and Blue Ridge Provinces	Coastal Plain Province		
			Cretaceous Sand Aquifer	Limestone-Sand Aquifer	Principal Artesian Limestone Aquifer
Number of Samples	22	12	11	6	14
Dates of Collection	6-9-37 to 5-3-58	9-30-58 to 10-21-58	8-6-44 to 6-30-53	2-4-38 to 2-3-54	2-9-38 to 7-27-43
Depth (feet)	Springs	Spring to 507	33.7 - 1,140	396 - 1,037	301 - 931
Temperature (^{o}F.)	62 - 81	63 - 74	64 - 77.5	76 - 77	70 - 77
Range of Analyses (parts per million)					
Dissolved Solids	45 - 236	14 - 687	27 - 197	131 - 218	152 - 528
Silica (SiO_2)	2 - 18	7.2 - 42	9.4 - 54	5.7 - 28	33 - 56
Iron (Fe)	0 - .45	0 - .08	.02 - .87	.01 - .90	.01 - .32
Calcium (Ca)	0 - 45	0.4 - 161	1.1 - 60	5.8 - 47	18 - 77
Magnesium (Mg)	Trace - 19	.2 - 5.6	0.5 - 1.7	.7 - 18	5.1 - 38
Sodium (Na)	Trace - 1.7	.2 - 26	1.1 - 17.2	1.1 - 74	4.4 - 56
Potassium (K)	Trace - 1.7	0.6 - 4.6			1.1 - 4.2
Bicarbonate (HCO_3)	8 - 170	4 - 98	0 - 178	140 - 204	120 - 201
Carbonate (CO_3)	0 - Trace	0	0	0	0 - 7.9
Sulfate (SO_4)	Trace - 4.0	.2 - 366	1 - 25	0.2 - 16	4.2 - 117
Chloride (Cl)	1 - 7	0 - 18	1.2 - 11	2.1 - 8.8	2.8 - 52
Fluoride (F)	0 - 0.2	0 - 1.0	0 - .2	0 - .4	0 - 0.8
Nitrate (NO_3)	0 - 6.0	.2 - 21	0 - 6.4	0.09 - 2.0	0 - .25
Hardness as $CaCO_3$	12 - 188	2 - 410	5 - 157	26 - 166	86 - 348
pH	5.9 - 8.0	5.2 - 7.5			

Sources: U. S. Geological Survey and Joseph T. Callahan, "Large Springs in Northeastern Georgia," Georgia Mineral Newsletter, Vol. 11, No. 3, 1958, pp. 80-86.

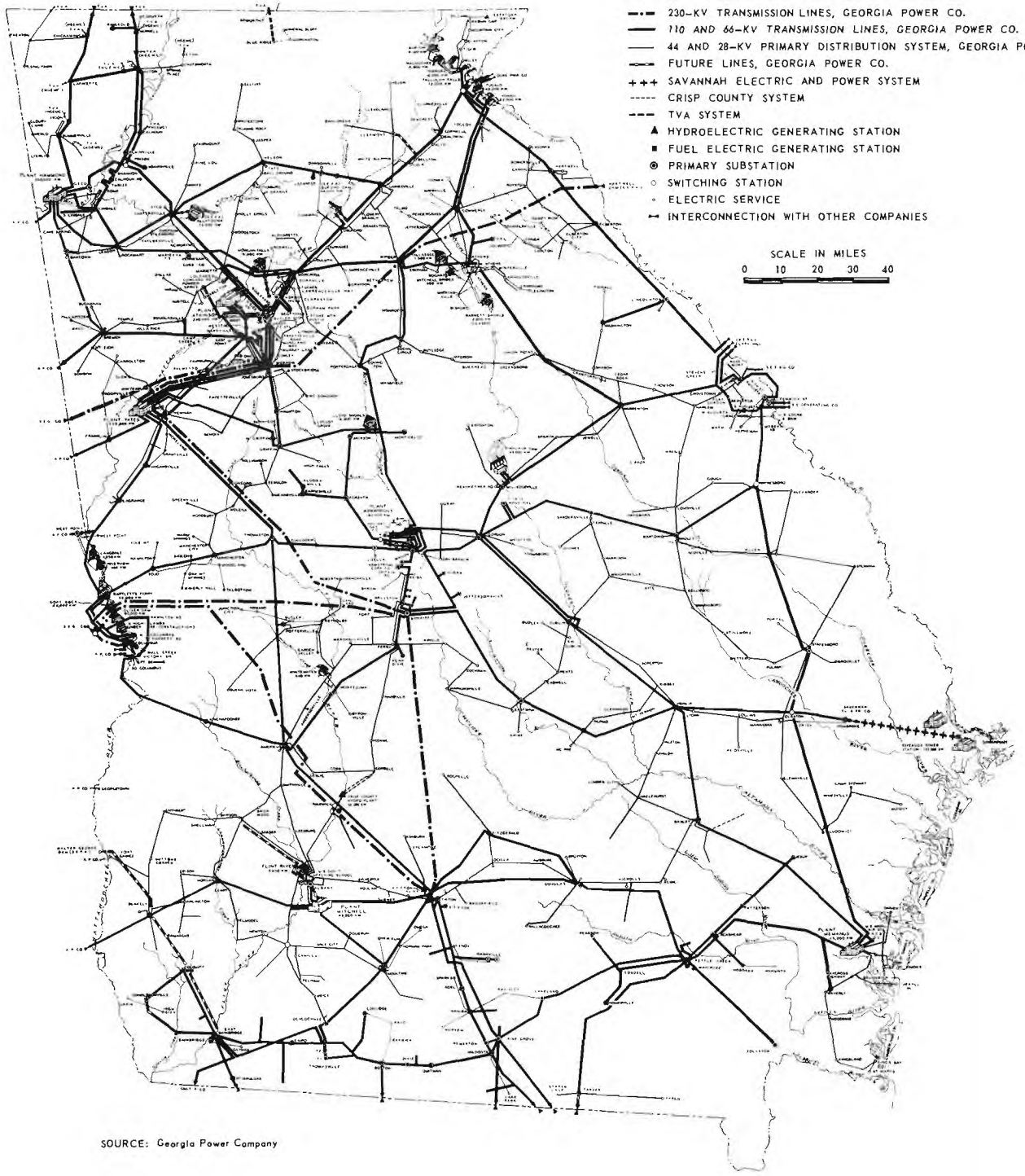
In the coastal areas of Brunswick and Jekyll Island, where the Ocala limestone aquifer is reached at 800- to 1,000-foot depths, wells capable of producing up to 2,000 gpm from this aquifer will cost approximately $20,000 each.

In the inland areas around Vidalia, Reidsville, Claxton, Metter, and Sylvania, and in Savannah on the coast, Ocala limestone is reached at depths of 600 to 800 feet; wells in these areas will have an average capacity of 600 to 800 gpm. A well and pump for delivery of this quantity of water will cost approximately $15,000.

Other inland areas, such as Louisville, Swainsboro, and Dublin, are reported to have "spotty" conditions in the local aquifers. At Dublin, for example, limestone is encountered at various depths down to 400 feet, with sand below that depth. Wells can be installed to a total depth of 700 feet to take water from both the limestone and sand horizons with yields up to 1,500 to 2,000 gpm, at a cost of approximately $20,000, including pump. At Louisville, water is available by screening from sand at a depth of about 400 feet, and a well of 600- to 800-gpm capacity will cost approximately $10,000. At Swainsboro, a recent well on one side of town produced 500 gpm from a streak of porous limestone at a depth of 367 feet, with total well and pump cost being approximately $10,000. Another well drilled on the opposite side of town had to go to the 900-foot depth to obtain the same volume of water by screening from sand. This well and pump cost approximately $20,000.

MAP 22

GEORGIA'S ELECTRIC POWER GENERATION, TRANSMISSION, AND PRIMARY DISTRIBUTION SYSTEM



SOURCE: Georgia Power Company

OTHER RESOURCES IN GEORGIA

Electric Power

A billion dollars is invested in electric power generating and transmission facilities for Georgia. Installed generating capacity has increased nearly 130% during the past 10 years, and further expansion is underway to meet the state's increasing electric power requirements. Fuel electric generating stations near large load centers and hydroelectric generating stations in the mountainous sections of the state can produce more than three million kilowatts. Additional capacity is provided by the one-million-kilowatt Southern Electric Generating Company plant near Wilsonville, Alabama. The ownership, operating costs, and power output of the company are equally shared by the Georgia Power Company and the Alabama Power Company.

The Georgia Power Company serves approximately 90% of the state's area. Smaller areas are served by the Crisp County Power Commission, the Savannah Electric and Power Company, and the Tennessee Valley Authority. Generating facilities, transmission lines, and primary distribution lines in the state are shown on Map 22. Interconnections with systems in neighboring states provide additional or emergency capacity when needed, integrating several power systems for maximum efficiency.

Typical monthly electric bills for three rates of power consumption are shown for 64 U. S. cities in Table 18. It is the general policy of supplying companies in Georgia to extend service to the customer's premises and supply transformers to provide standard voltages. Specific rates and other details regarding service may be obtained from any of the supplying companies.

Fuels

Natural gas fulfills most industrial fuel requirements in Georgia, providing more therms per year than coal, fuel oil, and liquefied petroleum gas combined. Costs for these competitive fuels at five major Georgia cities are presented in Table 19.

Table 18

TYPICAL MONTHLY INDUSTRIAL ELECTRIC BILLS
FOR 64 U. S. CITIES

(Cities of 50,000 Population and More)

	150 Kilowatts 30,000 kwh	500 Kilowatts 100,000 kwh	1,000 Kilowatts 400,000 kwh
Gadsden, Ala.	$501	$1,573	$4,070
Mobile, Ala.	501	1,573	4,070
Phoenix, Ariz.	708	1,959	5,031
Little Rock, Ark.	575	1,696	4,657
Los Angeles, Cal.	423	1,262	3,422
San Francisco, Cal.	573	1,533	4,343
Denver, Colo.	559	1,589	4,374
Hartford, Conn.	727	2,103	5,798
New Haven, Conn.	566	1,626	5,166
Wilmington, Del.	615	1,711	4,744
Orlando, Fla.	650	1,750	4,875
St. Petersburg, Fla.	747	2,016	6,797
Albany, Ga.	509	1,408	3,806
Atlanta, Ga.	564	1,522	4,015
Augusta, Ga.	564	1,522	4,015
Columbus, Ga.	564	1,522	4,015
Macon, Ga.	564	1,522	4,015
Savannah, Ga.	522	1,548	4,050
Chicago, Ill.	756	2,009	5,024
Peoria, Ill.	634	1,919	5,803
East Chicago, Ind.	666	1,734	4,568
South Bend, Ind.	600	1,737	4,965
Sioux City, Ia.	649	1,965	5,870
Topeka, Kan.	540	1,681	4,599
Lexington, Ky.	609	1,801	5,176
Louisville, Ky.	565	1,673	4,460
Baton Rouge, La.	678	1,903	5,295
New Orleans, La.	582	1,565	4,525
Portland, Me.	636	2,149	5,138
Baltimore, Md.	753	2,328	6,265
Boston, Mass.	751	2,180	6,078
Detroit, Mich.	699	2,025	5,582
Duluth, Minn.	703	2,089	6,356

Table 18 (continued)

	150 Kilowatts 30,000 kwh	500 Kilowatts 100,000 kwh	1,000 Kilowatts 400,000 kwh
Jackson, Miss.	648	1,793	4,890
St. Louis, Mo.	561	1,741	5,016
Butte, Mont.	467	1,342	3,742
Lincoln, Neb.	554	1,696	4,629
Las Vegas, Nev.	522	1,583	4,421
Concord, N. H.	563	1,826	5,489
Newark, N. J.	695	1,849	4,946
Albany, N. Y.	511	1,390	3,848
Binghampton, N. Y.	637	1,781	5,150
Buffalo, N. Y.	469	1,252	3,385
New York (all boroughs)	849	2,415	6,872
Charlotte, N. C.	420	1,340	3,600
Raleigh, N. C.	433	1,385	4,065
Grand Forks, N. Dak.	838	2,346	6,821
Cincinnati, O.	643	1,728	4,760
Toledo, O.	705	2,042	6,047
Tulsa, Okla.	588	1,578	4,216
Portland, Ore.	405	1,164	2,789
Erie, Pa.	696	1,940	4,902
Pittsburgh, Pa.	606	1,663	4,560
Pawtucket, R. I.	703	2,068	5,954
Charleston, S. C.	616	1,567	4,062
Columbia, S. C.	616	1,567	4,062
Greenville, S. C.	420	1,340	3,600
Rapid City, S. Dak.	697	1,936	5,493
Knoxville, Tenn.	360	1,010	2,410
Nashville, Tenn.	360	1,010	2,410
Dallas, Tex.	602	1,610	3,917
Richmond, Va.	620	1,810	4,910
Charleston, W. Va.	536	1,398	4,693
Green Bay, Wisc.	782	2,225	5,615

Source: Federal Power Commission, Typical Electric Bills, Jan. 1, 1961

Table 19

COMPETITIVE FUEL DATA FOR FIVE GEORGIA CITIES

Fuel	Athens		Atlanta		Augusta		Macon		Rome	
	Current Cost per Unit	Cost per Therm as Purchased	Current Cost per Unit	Cost per Therm as Purchased	Current Cost per Unit	Cost per Therm as Purchased	Current Cost per Unit	Cost per Therm as Purchased	Current Cost per Unit	Cost per Therm as Purchased
#2 Fuel Oil	16.0¢/gal.	11.51¢	10.7¢/gal.	7.70¢	13.35¢/gal.	9.60¢	11.1¢/gal.	7.99¢	12.0¢/gal.	8.63¢
#2 Fuel Oil (special contract)					10.17¢/gal.	7.32¢				
#5 Fuel Oil	8.8¢/gal.	5.99¢	9.03¢/gal.	6.14¢	8.6¢/gal.	5.85¢	9.65¢/gal.	6.56¢	10.5¢/gal.	7.14¢
#5 Fuel Oil (special contract)					7.9¢/gal.	5.40¢				
#6 Fuel Oil	7.6¢/gal.	5.00¢	7.70¢/gal.	5.07¢	7.0¢/gal.	4.61¢	7.46¢/gal.	4.91¢	8.5¢/gal.	5.59¢
#6 Fuel Oil (special contract)					6.75¢/gal.	4.44¢				
Stoker Coal			$9.57/ton	3.42¢						
Steam Coal (carbon)			$7.64/ton	2.87¢			$8.30/ton	3.19¢		
Steam Coal (nut and slack)	$9.00/ton	3.21¢	$8.12/ton	3.12¢	$9.00/ton	3.38¢	$13.00/ton	4.89¢	$9.00/ton	3.46¢
Steam Coal (nut and slack) (special contract)					$8.87/ton	3.33¢				
LP Gas (local truck)	15.0¢/gal.	16.39¢	12.0¢/gal.	13.11¢			14.0¢/gal.	15.30¢	15.0¢/gal.	16.39¢
LP Gas (large volume)	10.0¢/gal.	10.93¢	10.0¢/gal.	10.93¢	10.04¢/gal.	10.93¢	10.0¢/gal.	10.93¢	10.0¢/gal.	10.93¢
Natural Gas (part firm)[a]	4.02¢/therm	4.02¢	3.14¢/therm	3.14¢	2.80¢/therm	2.80¢	3.10¢/therm	3.10¢	2.84¢/therm	2.84¢
Natural Gas (interruptible)	4.0¢/therm	4.0¢	2.76¢/therm	2.76¢	2.76¢/therm	2.76¢	2.76¢/therm	2.76¢	2.76¢/therm	2.76¢

a/ Atlanta Gas Light Company average costs for 12 months ending September 30, 1962.

Source: Atlanta Gas Light Company (October 1, 1962)

Coal

Coal-using industries are economically supplied by bituminous mines in Alabama, Tennessee, Kentucky, and Virginia -- sources generally recognized for quality coals adaptable to every type of burning problem. Dependable supplies of nut, stoker, stove-size, egg, and block coal are available.

Fuel Oil

Number 6 fuel oil (Bunker C) dominates Georgia's industrial fuel oil use pattern. Bulk storage facilities at Savannah and Brunswick ocean terminals provide Bunker C oil for approximately $2.40 per barrel in large quantities.

Two refined petroleum products pipeline companies serving Georgia (Map 11) have a combined daily pumping capacity of 343,000 barrels. Southeastern Pipe Line Company operates an eight-inch line in west Georgia which originates at Port St. Joe in northern Florida. Plantation Pipe Line Company operates both 12 and 18-inch lines in southern and central Georgia. This system originates in Louisiana fields.

A third carrier, Colonial Pipeline Company, is constructing a 36-inch line across northern Georgia. Originating in the Houston-Beaumont-Port Arthur and Lake Charles areas of Texas and Louisiana, the line initially will transport 645,000 barrels of refined petroleum products daily.

Gas

Natural gas is supplied in Georgia by three major pipeline companies. These lines and connected distribution systems are shown on Map 23.

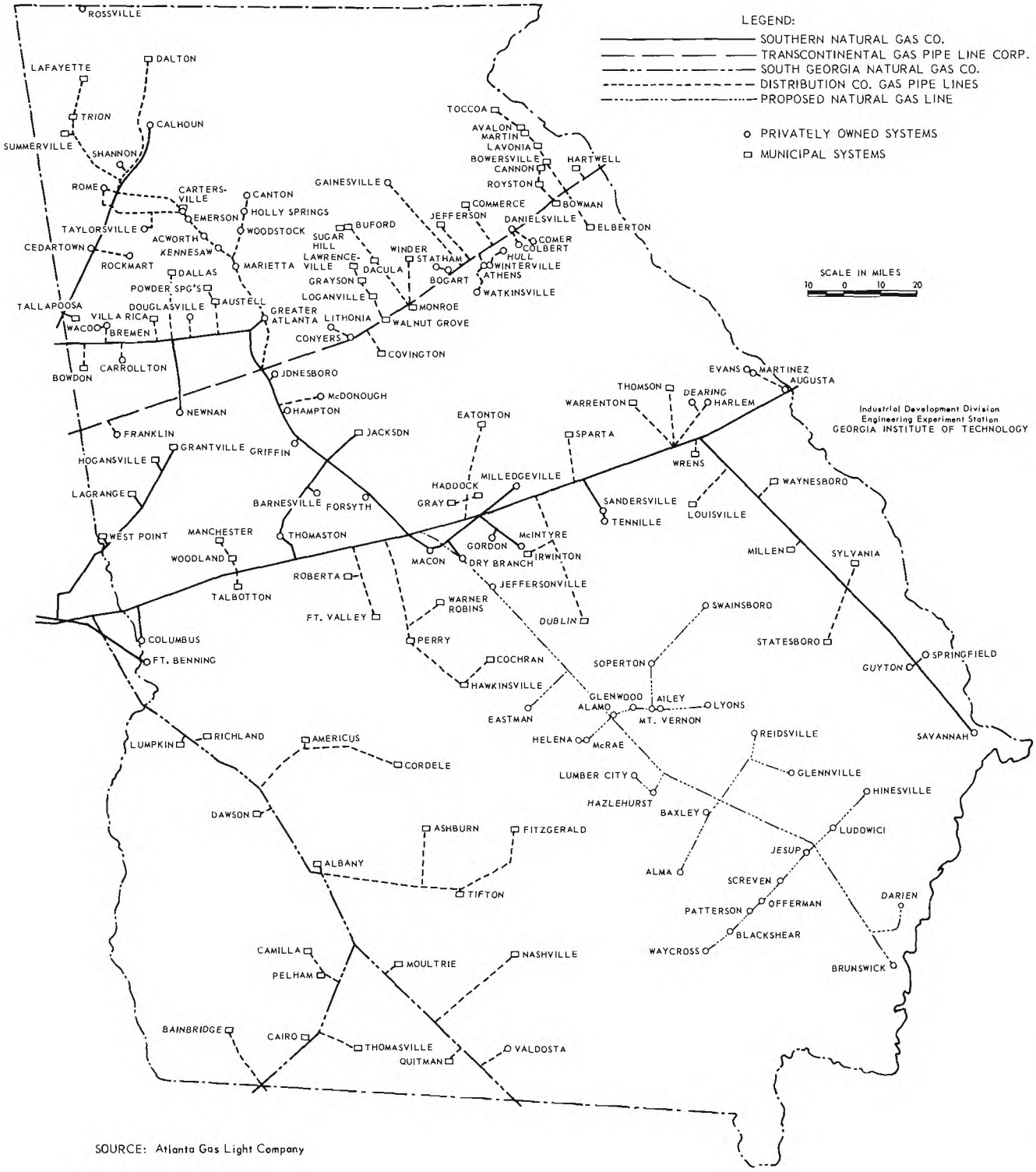
Manufactured or liquefied petroleum gas is available in most communities not served by natural gas. The liquefied petroleum gas line operated by Dixie Pipeline Company is shown on Map 11.

Natural gas costs are low in Georgia because of the state's proximity to the production fields of the mid-continental South. Table 20 presents data on natural gas rates in Atlanta and Columbus, Georgia, and in 21 other cities.

Sites

This section is restricted to the identification of a number of potential site areas for heavy chemical manufacturing -- areas on or near roads, rivers,

MAP 23
NATURAL GAS FACILITIES IN GEORGIA



SOURCE: Atlanta Gas Light Company

Table 20

COMPARATIVE NATURAL GAS RATES FOR 23 U. S. CITIES

	10,000 Therms/mo (1,000 MCF)[1]	50,000 Therms/mo (5,000 MCF)[2]	100,000 Therms/mo (10,000 MCF)[2]
Oklahoma City, Okla.	$254	$1,044	$1,945
Houston, Tex.	268	1,000	(a)
Memphis, Tenn.	412	1,282	2,213
Atlanta, Ga.	467	1,380	2,760
Columbus, Ga.	478	1,574	2,858
Kansas City, Mo.	488	1,314	2,558
San Francisco, Cal.	598	2,614	4,964
Louisville, Ky.	602	2,540	4,890
Gaffney, S. C.	611	1,919	3,319
St. Louis, Mo.	612	(a)	(a)
Cincinnati, O.	628	3,108	6,209
Columbia, S. C.	665	(b)	(b)
Athens, Tenn.	675	2,210	4,410
Cleveland, O.	678	3,133	6,083
Knoxville, Tenn.	724	3,173	4,188
Chicago, Ill.	741	1,575	3,150
Nashville, Tenn.	750	1,500	3,000
Richmond, Va.	780	3,580	7,080
Bristol, Va.	795	2,300	4,550
Detroit, Mich.	838	2,366	4,731
Chattanooga, Tenn.	845	2,290	4,340
Syracuse, N. Y.	968	3,471	6,921
Charlotte, N. C.	1,206	2,225	6,050

1/ Firm service

2/ Interruptible service

(a) Rates negotiated by special contract

(b) Rates not quoted

Source: Based on American Gas Association Rate Book, September 23, 1963.

and railroads. More detailed information on these site areas and on sites which meet the less demanding requirements of chemical formulators and light chemical processors is available from the agencies listed in Table 21 and from local chambers of commerce.

Map 24 is a topographic map of Georgia on which railroad routes have been superimposed. The 68 potential site areas indicated on this map are identified in Table 22.

In potential site areas north of the Fall Line, the rivers, most of which are regulated, are likely to be the only dependable large-volume water source. None of the site areas have navigable water at present. Because this part of the state is generally hilly, and even mountainous in the northeastern section, large, level sites are relatively scarce. Field surveys conducted in areas 8, 63, and 66 to 68 have turned up a few good sites comprising 300 to 400 acres.

The potential site areas south of the Fall Line, in the Coastal Plain, are likely to enjoy the flexibility inherent in having both ground and surface water supplies. Even the brackish waters which occur in the ocean estuaries have proved suitable for cooling purposes. Areas 1 to 5, 13, 14, 25, 34, and 54 to 57 are on navigable channels. This part of the state generally has gently rolling to level land, so sites are numerous and can be quite large. However, in those areas where the rivers have wide flood plains, land high enough to provide flood-free plant sites may be well removed from the river channel. Field surveys conducted in areas 1, 13, 14, 34, 54, and 57 have turned up several good sites in the 2,000 to 2,500-acre range.

A few specific sites which have been investigated by the Industrial Development Division are listed in Table 23. Each is considered suitable for immediate or near-future development for heavy chemical manufacturing. The table lists the site acreage, the agency with information on each site, and published references to each site.

Service Industries

One of the disadvantages of decentralized chemical processing operations is that it often is not economical for a branch plant to maintain its own equipment overhaul and repair shops and specialized engineering services. Non-company sources of these services may be necessary. A second disadvantage

Table 21

SELECTED INDUSTRIAL DEVELOPMENT AGENCIES

Atlanta Gas Light Company
Post Office Box 4569
Atlanta, Georgia

Atlantic Coast Line Railroad
87 Haynes Street, N. W.
Atlanta, Georgia

Central of Georgia Railway Company
1212 Rhodes Haverty Building
Atlanta, Georgia

Citizens & Southern National Bank
Post Office Box 4899
Atlanta, Georgia

Georgia Department of Industry and Trade
100 State Capitol Building
Atlanta, Georgia

Georgia Ports Authority
Healey Building
Atlanta, Georgia

Georgia Power Company
Post Office Box 4545
Atlanta, Georgia

Georgia Railroad Company
4 Hunter Street, S. W.
Atlanta, Georgia

Georgia State Chamber of Commerce
1200 Commerce Building
Atlanta, Georgia

Industrial Development Division
Engineering Experiment Station
Georgia Institute of Technology
680 West Peachtree Street, N. W.
Atlanta, Georgia

Savannah District Authority
Post Office Box 768
Savannah, Georgia

Seaboard Air Line Railroad Company
22 Marietta Street, N. W.
Atlanta, Georgia

Southern Railway System
270 Peachtree Street, N. E.
Atlanta, Georgia

Trust Company of Georgia
36 Edgewood Avenue, N. E.
Atlanta, Georgia

MAP 24

POTENTIAL SITE AREAS IN GEORGIA ON OR NEAR RIVERS AND RAILROADS

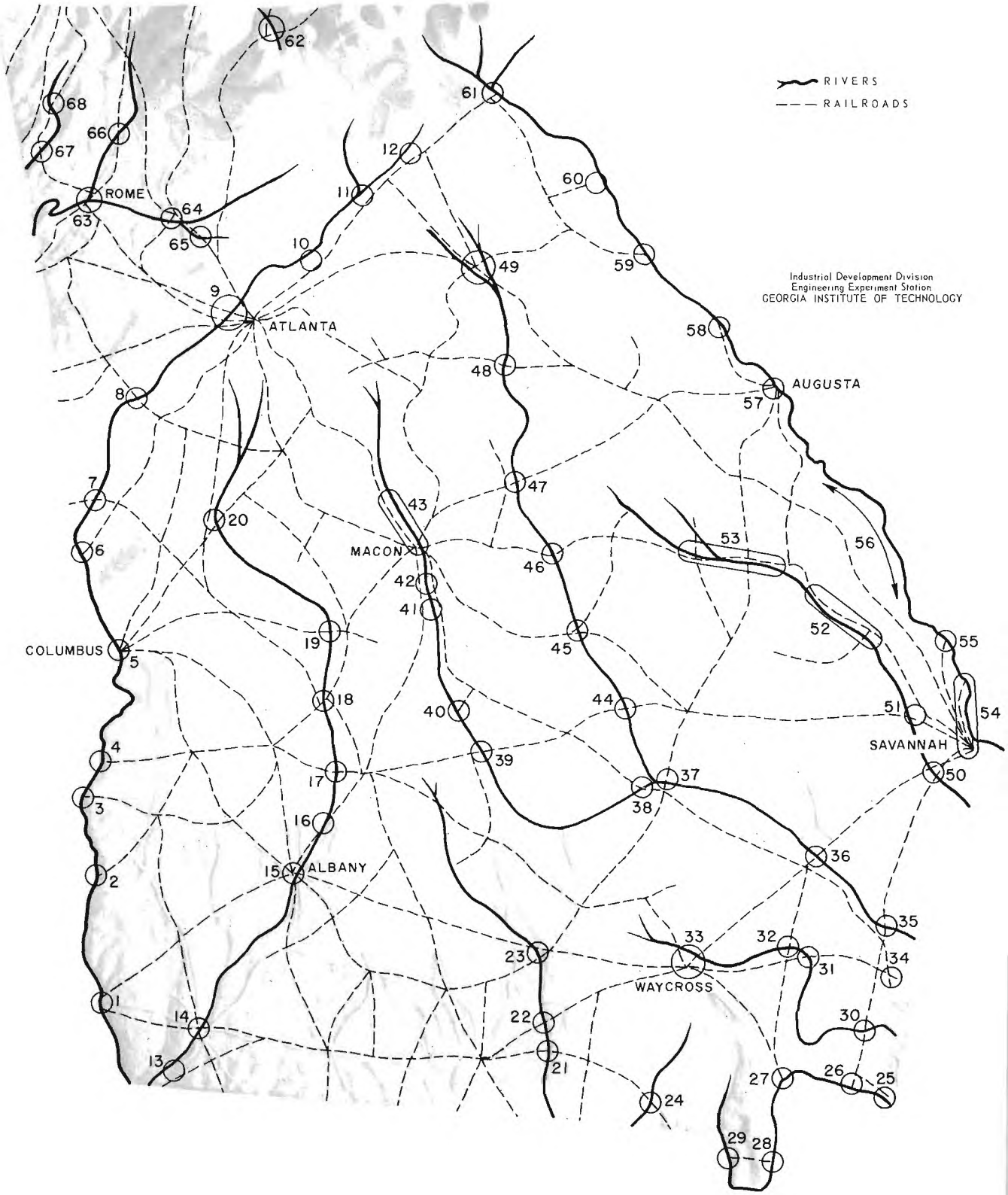


Table 22

IDENTIFICATION OF POTENTIAL SITE AREAS IN GEORGIA
ON OR NEAR RIVERS AND RAILROADS

(Site Area Numbers Refer to Map 24)

Site Area Number	River	Railroads	County (City)
1	Chattahoochee (slack water, 9-foot channel)	Chattahoochee Industrial Central of Georgia Atlantic Coast Line	Early
2	Chattahoochee (slack water, 9-foot channel)	Central of Georgia (does not cross river)	Clay (Fort Gaines)
3	Chattahoochee (slack water, 9-foot channel)	Central of Georgia	Quitman (Georgetown)
4	Chattahoochee (slack water, 9-foot channel)	Seaboard Air Line	Stewart (Omaha)
5	Chattahoochee (9-foot channel)	Central of Georgia Southern Seaboard Air Line	Muscogee (Columbus)
6	Chattahoochee	Atlanta & West Point	Harris - Troup (West Point)
7	Chattahoochee	Atlanta Coast Line	Troup (LaGrange)
8	Chattahoochee	Central of Georgia	Carroll (Whitesburg)
9	Chattahoochee	Southern Seaboard Air Line	Fulton (Atlanta)
10	Chattahoochee	Southern	Gwinnett (Duluth)
11	Chattahoochee	Southern	Gwinnett (Buford)
12	Chattahoochee	Southern	Hall (Gainesville)
13	Flint (9-foot channel)	Atlantic Coast Line	Decatur (Lake Seminole)
14	Flint (slack water, 9-foot channel)	Atlantic Coast Line Seaboard Air Line	Decatur (Bainbridge)
15	Flint (channel proposed)	Central of Georgia Seaboard Air Line	Dougherty (Albany)

Table 22 (continued)

Site Area Number	River	Railroads	County (City)
16	Flint	Albany & Northern	Worth (Oakfield)
17	Flint (slack water)	Seaboard Air Line	Sumter, Crisp (Lake Blackshear)
18	Flint	Central of Georgia Atlantic Coast Line	Oglethorpe (Montezuma)
19	Flint	Central of Georgia	Taylor - Crawford (Reynolds)
20	Flint	Southern	Pike (Molena)
21	Alapaha	Southern	Echols (Howell)
22	Alapaha	Atlantic Coast Line	Lowndes (Naylor)
23	Alapaha	Atlantic Coast Line	Atkinson (Willacoochee)
24	Suwannee	Southern	Clinch (Fargo)
25	St. Marys (9-foot channel, deepwater port)	Saint Marys	Camden (St. Marys - Kings Bay)
26	St. Marys	Seaboard Air Line	Camden (Kingsland)
27	St. Marys	Atlantic Coast Line	Charlton (Folkston)
28	St. Marys	Southern	Charlton (St. George)
29	St. Marys	Southern	Charlton (Moniac)
30	Satilla	Seaboard Air Line	Camden (Woodbine)
31	Satilla	Atlantic Coast Line	Brantley (Nahunta)
32	Satilla	Atlantic Coast Line	Brantley (Nahunta)
33	Satilla	Atlantic Coast Line	Ware (Waycross)

Table 22 (continued)

Site Area Number	River	Railroads	County (City)
34	Brunswick (9-foot channel, deepwater port)	Southern Atlantic Coast Line	Glynn (Brunswick)
35	Altamaha	Seaboard Air Line	McIntosh (Everett)
36	Altamaha	Atlantic Coast Line Southern	Wayne (Doctortown)
37	Altamaha	Georgia & Florida	Jeff Davis (Hazlehurst)
38	Ocmulgee	Southern	Telfair (Lumber City)
39	Ocmulgee	Seaboard Air Line	Wilcox (Abbeville)
40	Ocmulgee	Southern	Pulaski (Hawkinsville)
41	Ocmulgee	Southern	Twiggs (Tarversville)
42	Ocmulgee	Southern	Peach - Twiggs (Warner Robins, north)
43	Ocmulgee	Southern Central of Georgia Seaboard Air Line	Bibb (Macon, north)
44	Oconee	Seaboard Air Line	Montgomery (Mount Vernon)
45	Oconee	Seaboard Air Line	Laurens (Dublin)
46	Oconee	Central of Georgia	Washington (Gardner Station)
47	Oconee (Lake Sinclair)	Central of Georgia	Baldwin (Milledgeville)
48	Oconee	Georgia	Greene (Greensboro)
49	Oconee	Seaboard Air Line Southern Georgia	Clarke (Athens)
50	Ogeechee	Atlantic Coast Line Seaboard Air Line	Bryan - Chatham (Richmond Hill)
51	Ogeechee	Central of Georgia Seaboard Air Line	Screven (Eden to Oliver)

Table 22 (continued)

Site Area Number	River	Railroads	County (City)
52	Ogeechee	Central of Georgia	Screven - Jenkins (Oliver to Millen)
53	Ogeechee	Central of Georgia	Jenkins - Jefferson (Millen to Wadley)
54	Savannah (9-foot channel, deepwater port)	Seaboard Air Line Atlantic Coast Line Savannah & Atlanta	Chatham (Savannah)
55	Savannah (9-foot channel)	Seaboard Air Line	Effingham (Clyo)
56	Savannah (9-foot channel)	Savannah & Atlanta	Effingham (Clyo to Shell Bluff)
57	Savannah (9-foot channel)	Central of Georgia Georgia & Florida Georgia	Richmond (Augusta)
58	Savannah	Georgia & Florida	Columbia (Evans)
59	Savannah	Southern	Elbert (Heardmont)
60	Savannah (Hartwell Reservoir)	Hartwell	Hart (Hartwell)
61	Tugaloo	Southern	Stephens (Toccoa)
62	Toccoa	Louisville & Nashville	Fannin (Blue Ridge)
63	Coosa Oostanaula Etowah	Central of Georgia	Floyd (Rome)
64	Etowah	Seaboard Air Line	Bartow (Ladds and Cartersville)
65	Allatoona	Louisville & Nashville	Cobb (Acworth)
66	Oostanaula	Louisville & Nashville Southern	Gordon (Calhoun)
67	Chattooga	Central of Georgia	Chattooga (Lyerly)
68	Chattooga	Central of Georgia	Chattooga (Summerville)

Table 23

SOME SPECIFIC POTENTIAL CHEMICAL PLANT SITES IN GEORGIA

(Site Area Numbers Refer to Map 24)

Site Area No.	County (City) and Site	Acreage	Published Reference	Agency Contact
1	Early (Saffold):			Blakely Chamber of Commerce
	Spooner-Clark Tract	188	1/, p.13	
	Tomley-Miller Area	480+	1/, p.14	
	J. W. Brunson Tract	350+	1/, p.15	
1	Early (Hilton):			Blakely Chamber of Commerce
	Mary F. Freeman Farm	165	1/, p.19	
8	Carroll (Whitesburg):			Carroll County Development Commission (Carrollton)
	A. O. Dyer Property	300+	2/, p.59	
14	Decatur (Bainbridge):			Growth, Inc.
	Ports Authority	80±	3/, p.4	
	Decatur County	123	3/, pp.2,4	
	John Grimsley, Jr.	45±	3/, p.5	
	R. M. Reynolds, Jr.-Sr.	190+	3/, p.5	
34	Glynn (Brunswick):			Georgia Ports Authority (Atlanta)
	Colonels Island, Georgia Ports Authority	2,000+	4/	
54	Chatham (Savannah):			Georgia Ports Authority (Atlanta), or Savannah District Authority
	Whitehall Plantation, Georgia Ports Authority	390	5/, p.25	
	Rice Hope Plantation (Chisholm Property), 10 miles north of city	2,500	None	
57	Richmond (Augusta):			Committee of 100 (Augusta), or Central Savannah River Planning and Development Commission (Augusta)
	Miracle Mile District (Empire Land Co., subsidiary of Central of Georgia Railway)	400±	None	
	Baxter-Scott Tracts	631	None	
	Raymond Floyd Farm	2,300	None	

Table 23 (continued)

Site Area No.	County (City) and Site	Acreage	Published Reference	Agency Contact
63	Floyd (Rome):			Coosa Valley Area Planning and Development Commission (Rome)
	Frank Weathers Tract, 7 miles west of city	138	6/, p.169	
64	Bartow (Cartersville):			Coosa Valley Area Planning and Development Commission (Rome)
	Conyers Development Corp. Industrial District	400+	6/, p.16	
64	Bartow (Ladds):			Coosa Valley Area Planning and Development Commission (Rome)
	Henderson and Keown Tracts	227	6/, p.23	
66	Gordon (Reeves):			Coosa Valley Area Planning and Development Commission (Rome)
	Reeves Area, 4 miles southwest of Calhoun	200-350	6/, p.197	
68	Chattooga (Summerville)			Coosa Valley Area Planning and Development Commission (Rome)
	Selman Tract	325+	6/, p.79	

Published References:

1/ George I. Whitlatch and Roger K. Sund, Survey of Industrial Sites Along the Chattahoochee River in Early County, Georgia, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, December 1962, 29 pp.

2/ George I. Whitlatch and Wallace B. Bishop, Jr., Industrial Site Survey of Carroll County, Georgia, Industrial Development Division, June 1962, 70 pp.

3/ George I. Whitlatch and Robert L. Ware, Design and Management Procedure for the Unified Development of Industrial Properties in an Area at Bainbridge, Georgia, Industrial Development Division, May 1963, 18 pp.

4/ George I. Whitlatch and Wade McKoy, Preliminary Design Plans for Colonels Island, a memorandum to Kenneth C. Wagner, Industrial Development Division, March 1963, 13 pp.

5/ A Survey of the Industrial Advantages of the City and Port of Savannah, Georgia, Committee on Industrial Development, Savannah District Authority, Savannah, Georgia, October 1962, 54 pp.

6/ George I. Whitlatch, Coosa Valley Industrial Site Handbook, Industrial Development Division, April 1962, 284 pp.

is that traditional vendors of processing equipment or packaging supplies may not offer efficient service to a branch plant location. It is frequently necessary to establish working relationships with entirely new sources of these services.

Shops in Georgia are adequate for general overhauling and repair of machinery, equipment, instruments, and systems, but they may lack experience with some kinds of specialized equipment. Shops of all kinds are available in all parts of the state. There are, for example, 82 jobbing and repair machine shops in 41 Georgia communities.

More than 100 consulting engineering firms in Georgia offer technical service in such diverse areas as communication systems and corrosion control. Consulting industrial engineers provide a complete range of services in such fields as methods improvement, operator development, rate setting, order-invoice procedures, warehousing methods and facilities, and office methods.

Engineering and architectural firms provide service in soil sciences, land planning, plant and process design, foundation engineering, structural engineering, materials of construction, industrial water treatment, industrial waste disposal, heating, air conditioning and ventilating. Experience ranges from small office buildings to aerospace propellant manufacturing plants. Technical services are available for all aspects of the chemical specialties industry, including formulation, testing, evaluation, label compliance, registration, and technical sales promotion. Staffs range from one to 330.[1/]

Chemical processing branch operations in Georgia should have no difficulty in establishing sources of processing equipment or packaging supplies. Most major vendors maintain distribution facilities in the state, and some manufacture selected products. Manufacturers and suppliers of manufacturing and materials-handling equipment and construction materials with facilities in Georgia are listed in Table 24. Most of the 153 listed are located in Atlanta.

1/ For further details on industrial research and consulting services in Georgia see Directory of Scientific Resources in Georgia, 1962-1963, edited by Tattie W. Roan, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, July 1963.

Table 24

SOME MANUFACTURERS AND SUPPLIERS OF CONSTRUCTION MATERIALS AND MANUFACTURING AND MATERIALS-HANDLING EQUIPMENT WITH FACILITIES IN GEORGIA

Acme-Hamilton Manufacturing Corporation
Acme Steel Company
Aeroquip Corporation
Aluminum Company of America
American Air Filter Company, Inc.
American Biltrite Rubber Company
American Chain & Cable Company, Inc.
American Felt Company
American LaFrance
American Optical Company
American Radiator & Standard Sanitary Corporation
American Sterilizer Company
Ametek, Inc.
Anaconda American Brass Company
Anchor Hocking Glass Corporation
Armco Steel Corporation

The Babcock & Wilcox Company
Bailey Meter Company
Baird-Atomic, Inc.
The Bastian-Blessing Company
Bausch & Lomb, Inc.
Beckman Instruments, Inc.
Bird Machine Company
Borg-Warner Corporation
Bridgeport Brass Company
The Bristol Company

Calumet & Hecla, Inc.
The Cambridge Wire Cloth Company
Carborundum Company
Philip Carey Manufacturing Company
Carpenter Steel Company
Century Electric Company
Chain Belt Company
Chase Brass & Copper Company
Chemetron Corporation
Chicago Bridge & Iron Company
Chicago Pneumatic Tool Company
Clarage Fan Company
Clark Brothers Company
Connecticut Hard Rubber Company
Consolidated Electrodynamics Corporation
Consolidated Vacuum Corporation
Continental Conveyor & Equipment Company
Crane Company
Crouse-Hinds Company
Crucible Steel Company of America
Cunningham-Limp Company
Cutler-Hammer, Inc.

Davidson Kennedy Company
Davis Foundry & Machine Works
Dean Brothers Pumps, Inc.
DeLaval Separator Company
The DeVilbiss Company
Diamond Chain Company, Inc.
Dorr-Oliver, Inc.
Dresser Industries, Inc.

Eastern Stainless Steel Corporation
Eastman Kodak Company
Edward Valves, Inc.
Electra Motors, Inc.
Electric Machinery Manufacturing Company
Eriez Manufacturing Company

Farrel-Birmingham Company, Inc.
Federal-Mogul-Bower Bearings, Inc.
Flexible Tubing Corporation
Flexi-Liner Company
FMC Corporation
Frick Company
Fruehauf Trailer Company

Gardner-Denver Company
General Controls Company
General Dynamic Corporation
General Electric Company
Goodall Rubber Company
B. F. Goodrich Industrial Products Company
Goulds Pumps, Inc.
Gray Company, Inc.
Great Lakes Corporation
Grinnell Company, Inc.
Gustin Bacon Manufacturing Company

Harvey Aluminum
Havey Corporation
Hills-McCanna Company
E. F. Houghton & Company
Howe Scale Company

Table 24 (continued)

Ingersoll-Rand Company
Inland Steel Company
International Harvester Company
International Paper Company

Jarrell-Ash Company
The Jeffrey Manufacturing Company
Jenkins Brothers
Johnson & Johnson
Joy Manufacturing Company

Keasbey & Mattison Company
Kellogg-American, Inc.
Kennedy Valve Manufacturing Company
Walter Kidde & Company, Inc.

The Lincoln Electric Company
Lord Manufacturing Company

McNeil Machine & Engraving Company
Manning, Maxwell & Moore, Inc.
Mechanical Handling Systems, Inc.
Metalab Equipment Company
Minneapolis - Honeywell Regulator Company
Minnesota Mining & Manufacturing Company
Moore Products Company
Morehouse-Cowles, Inc.

N R C Equipment Corporation
National Filter Media Corporation
National Vulcanized Fibre Company
Neptune Meter Company
New York Air Brake Company
Niagara Blower Company
Norton Company

Parks-Cramer Company
The Patterson Foundry & Machinery Company
The Perkin-Elmer Corporation
Pettibone Mulliken Corporation
Phillips Electronic Instruments
Pittsburgh-Des Moines Steel Company
The Polymer Corporation
Pressed Steel Tank Company

Republic Steel Corporation
Resistoflex Corporation
Revere Copper & Brass, Inc.
Howe Richardson Corporation
Riley Stoker Corporation
Rockwell Manufacturing Company

SKF Industries, Inc.
St. Regis Paper Company
The Seigler Corporation
The Sharples Corporation
Stephens-Adamson Manufacturing Company
Stillman Rubber Company
Stockham Valves & Fittings

Taylor Forge & Pipe Works
Taylor Instrument Companies
Techalloy Company, Inc.
The Timkin Roller Bearing Company
Thompson Ramo Woolridge, Inc.
Toledo Scale Corporation
Trent Tube Company
Tube Turns Plastics, Inc.
The W. S. Tyler Company

The Union Bag-Camp Paper Corporation
U. S. Electric Motors, Inc.

Walworth Company
Waukesha Foundry Company
Wellington Sears Company
Westinghouse Air Brake Company

Yarnall-Waring Company

Plants manufacturing metal, plastic, and glass containers in Georgia are:

Plant	Location	Products
American Can Company	Atlanta (Forest Park)	Oblong cans, beer cans, carbonated beverage cans, paper tubes with metal ends, lithographing facilities
American Can Company	Savannah	Coffee cans and other cans
Crown Cork & Seal Company	Atlanta	General open-top cans, aerosol cans, aluminum cans, beer cans, bottle crowns, oblong cans, lithographing facilities
Knox Glass Company	Atlanta (Forest Park)	Glass containers
Owens-Illinois Glass Company		
Glass Container Division	Atlanta	Glass containers
Plastic Products Division	Atlanta	High density polyethylene bottles
Polyco, Inc.	Atlanta (Smyrna)	High and low density polyethylene bottles

Plants manufacturing paper, fiber, and wood containers in Georgia are too numerous to be listed with company name, location, and products. The number of plants are listed below by Standard Industrial Classification (SIC) number.

SIC	Number of Plants	Products
2651	6	Folding paperboard boxes
2652	7	Set-up paperboard boxes
2653	14	Corrugated and solid fiber boxes
2654	10	Sanitary food containers
2655	8	Fiber cans, tubes, drums, and similar products
2441	14	Nailed and lock-corner wooden boxes and shook
2442	20	Wirebound boxes and crates
2443	6	Veneer and plywood containers, except boxes and crates
3491	3	Metal shipping barrels, drums, kegs, and pails

Other manufacturers and suppliers of packaging, containers, and bulk shipping equipment with offices in Georgia are listed in Table 25.

Table 25

MANUFACTURERS AND SUPPLIERS OF PACKAGING, CONTAINERS, AND BULK SHIPPING EQUIPMENT WITH OFFICES IN GEORGIA

Acme Steel Company
Aluminum Company of America
American Felt Company
Anchor Hocking Glass Corporation

Belmont Burlap Bag Company
Bethlehem Steel Company

The Philip Carey Manufacturing Company
Chicago Bridge & Iron Company
The Connecticut Hard Rubber Company
Continental Can Company, Inc.
Crown Zellerbach Corporation

E. I. du Pont de Nemours & Company, Inc.

Fasson Products
Fischer & Porter Company
Flexi-Liner Company
Fruehauf Trailer Company

B. F. Goodrich Industrial Products Company

Harvey Aluminum
The Heil Company

Johns-Manville Corporation
Johnson & Johnson

Walter Kidde & Company, Inc.

Olin Mathieson Chemical Corporation
Owens-Illinois Glass Company

Packaging Products & Design Corporation
Pressed Steel Tank Company

R C Can Company

St. Regis Paper Company
Spaulding Fibre, Inc.
Syntron Company

Union Bag-Camp Paper Corporation

West Virginia Pulp & Paper Company

Research and Testing Facilities[1/]

The Georgia Institute of Technology performs well over $4 million worth of research annually, a large part of which is applicable to the chemical industry. Among the chemical companies which have been served by Georgia Tech are American Cyanamid Company, Eastman Kodak Company, E. I. du Pont de Nemours & Company, Inc., Monsanto Chemical Company, Rayonier, Inc., and Union Carbide Corporation. The University of Georgia and Emory University also maintain extensive research facilities. In addition, more than 100 Georgia firms operate their own research or testing facilities.

Both the Engineering Experiment Station and the academic departments at Georgia Tech are engaged in research. The research staff of 650 at the Engineering Experiment Station is built around 300 experienced scientists and engineers. Approximately 200 of these devote full time to research, while the remaining 100 divide their time between teaching and research. They are supported by qualified technical assistants, machinists, and technicians, all under centralized administrative direction. Indicative of the capabilities of Tech's academic departments, the School of Chemistry has approximately 100 persons (faculty, graduate students, and technicians) engaged in active research programs in all fields of chemistry. The combined personnel and facilities of Tech's various research groups are available for both basic and applied research in most phases of science and engineering.

Laboratories for research in organic, inorganic, analytical, physical, and industrial chemistry are provided with standard chemical apparatus as well as specialized equipment, such as infrared, ultraviolet, and visible spectrophotometers; research refractometers, polarscopes, and polarographs; a three-meter Wadsworth-mounting Jarrell Ash spectrograph; a Leeds and Northrup recording microphotometer; catalytic hydrogenation apparatus; magnetic notation spectrum equipment; and nuclear magnetic resonance equipment.

Representative of projects in chemistry are programs on the applications of EDTA and related compounds; kinetics and reaction mechanisms of complex inorganic ions; radioactive exchange reactions; thermodynamic, kinetic, and

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1/ For additional information, see Directory of Scientific Resources in Georgia, 1962-1963, edited by Tattie W. Roan, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, 1963.

nuclear magnetic resonance phenomena of inorganic nitrogen compounds; organometallic compounds; mechanisms of biological reactions; effect of structure in the reactivity of organic compounds; synthesis of new barbituric acids, polynuclear aromatic compounds, cycloheptane derivatives, and methoxytetralones; polymer chemistry; transport properties of gases; and solid state chemistry.

Particular emphasis is being placed on the radiation chemistry of organic substances, with attention given to studying and characterizing all radiolysis products. Equipment includes a 12,000-curie cesium-137 irradiator, and Perkin-Elmer and Barber-Colmas gas chromatographs. A number of staff members are well versed in radiochemical separation and purification procedures, detection of radiations, and qualitative and quantitative uses of radioisotopes. A broad radioisotopes license allows Georgia Tech personnel to possess a total of 25 curies of radioelements of atomic numbers 3 to 83.

Research at low temperatures includes heat capacity measurements, studies in the superconductivity of metals and compounds, radiation transfer and thermal conductivity of metals. A time-in-flight mass spectrometer is among the precision equipment available for this type of work.

Current research in chemical engineering is emphasizing two-phase fluid and heat flows and phase equilibria in binary and ternary nitroparaffin-hydrocarbon systems. Radiochemical separations studies, involving the use of ion exchange and solvent extraction columns, are also underway. Special studies are being conducted on the dehydrogenization of butane, metal dusting, vortex formation and flow, solubility of molten halides in molten oxides, and low temperature physical and chemical properties of substances.

Metallurgical research has included studies in oxidation and carbon monoxide attack, metallic bonding and prediction of metallic properties from the electron concentration in the solid state, the effect of stress reversal on cooling velocity to aid in refining the thermal analysis for steels, and surface contamination and surface film growth with its attendant effects on joining of thermoelectric elements. The unusually broad scope of studies has required the use of electron microscopy, X-ray diffraction, computer programming, and the utilization of an ultra-high vacuum system.

Research capabilities in micromeritics cover the whole field of fine particle technology. Particle size determination, surface area analysis,

and pore volume evaluation are routine tasks for the micromeritics laboratory. Aerosol properties, spray formation, filtering action, fluidization, pneumatic and hydraulic transports, and other engineering operations that involve powders, slurries, or emulsions are also activities of the laboratory. Research on solid surface phenomena, such as heats of adsorption and surface energy, has grown out of the surface area studies. Work involving clouds, or micrometeorology, concerns solubilities of finely divided materials, rates of solution under various conditions, supercooling of water drops, and the like. Current studies related to air pollution involve the adhesion of particles and gaseous components and the extent of dust damage associated with certain industries.

Of special interest at Georgia Tech are the properties and applications of kaolin, the high-grade clay which is one of Georgia's most important mineral resources, and other ceramic materials native to the region. In studies of basic properties and reactions in ceramic materials, chemical techniques and optical microscopy are supplemented by X-ray, diffraction, electron microscopy, and differential thermal analysis. Projects concerning such subjects as various cermets from thermite reactions, recrystallization rates in nitreous silica, and the decomposition of clay minerals are examples of basic research on the properties of ceramic materials.

Representative research in sanitary engineering concerns studies of industrial waste treatment methods, stream sanitation, detection and handling of radionuclides in water and wastes, toxic biological reactions to chemicals and nuclides, automation of water and waste treatment plants, gas chromatographic techniques for air pollutants, and studies of desalting of salt and brackish waters.

Several laboratories of the Institute are staffed and equipped to study a large variety of chemical problems arising in industry, such as the corrosion of metals, the weathering of paints, and the development of new products and processes.

The Rich Electronic Computer Center provides both digital and analog computer services with a staff experienced in applications arising from scientific, statistical, engineering, and data processing areas.

The Georgia Tech research reactor is a heavy-water-moderated, heterogenous, enriched fuel reactor designed to permit operations up to a maximum power level of about five megawatts, with a flux of 10^{14} neutrons/cm^2- sec or more.

The University of Georgia promotes research through its general research program, several bureaus, and numerous grants and contracts obtained by its faculty members from sources outside the University. Agricultural research is conducted through the Agricultural Experiment Stations of the College of Agriculture.

General research involves 158 people who devote at least one-third time, and in some cases as much as three-fourths time, to research. In addition, eight full-time people, 172 research assistants, and 41 research scholars are on grants. The state-wide network of Agricultural Experiment Stations employs nearly 200 agricultural research scientists.

While a large part of the University's research effort is devoted to creative scholarship in the humanities and social sciences, research is also conducted in the natural sciences and the several fields of their application. The Department of Chemistry, for example, currently has 16 scientists involved in active research programs in analytical, biochemical, inorganic, organic, and physical chemistry.

Emory University spends approximately $2.5 million per year on research, primarily in the medical field. This effort is closely coordinated with that of the U. S. Public Health Service's Communicable Disease Center, which has an estimated research budget of $6 million per year. The Center is consolidating its national operations in Atlanta and is building extensive research facilities adjacent to the Emory campus.

More than 100 private firms in Georgia operate research or testing facilities. As would be expected, most activity is in the fields of pulp and paper by-products, naval stores, textile colorants and processing chemicals, and agricultural chemicals (including animal vitamins and drugs). Private research and testing facilities also serve the chemical specialties industry, especially manufacturers of pharmaceuticals, sanitary chemicals, paints and allied products, and detergents.

Technical Personnel and Training Facilities

Eighteen fully accredited universities and colleges in Georgia offer degrees in chemical engineering or chemistry. A total of 64 institutions of higher education are located in 36 counties in Georgia. Atlanta alone has 19 degree-granting colleges and universities.

Georgia universities and colleges granted 169 bachelor's degrees in chemistry and chemical engineering during the year ending June 1962. Thirty-six master's degrees and 10 doctorates were awarded in chemistry and chemical engineering during the same period. (See Table 26.) In 1963, Georgia Tech alone granted 16 of its 31 doctorate degrees in chemistry and chemical engineering.

Supplementing the professional schools are a network of junior colleges, Southern Technical Institute, two State-operated vocational-technical schools, and many public and private vocational schools throughout the state. To meet the joint needs of industry and the youth of the area, the State Department of Education recently provided for the development of a state-wide system of area vocational-technical schools. By the end of 1963, 12 of these schools will be in operation in Albany, Augusta, Columbus, DeKalb County, Marietta, Rome, Swainsboro, Thomasville, and Valdosta. Fourteen others are in some stage of planning or construction in Athens, Atlanta, Augusta, Griffin, Macon, Moultrie, Savannah, Thomaston, and Waycross. When completed, the area vocational-technical school in Atlanta will be the largest of its kind in the country.

Salaries for engineering and management positions are relatively standard through the United States, since these employment groups are particularly mobile. Regional location does not assume the importance that it does for non-professional production workers. In some areas it may be necessary to offer salaries which are higher than the standard for a given function in order to offset the disadvantages of unpleasant climate or living conditions, high cost of living, or isolation. Georgia has none of these disadvantages.[1/]

1/ Living costs in Atlanta were next to the lowest of 20 large cities included in recent cost-of-living comparisons published by the U. S. Department of Labor and updated to reflect changes through late 1961. The study showed that living costs in Atlanta were 14% less than in Chicago, 13% less than in Boston, 12% less than in San Francisco and Los Angeles, 9% less than in Cleveland, 7% less than in New York, and 5% less than in Philadelphia.

Table 26

CHEMISTRY AND CHEMICAL ENGINEERING DEGREES
CONFERRED BY GEORGIA INSTITUTIONS,
YEAR ENDING JUNE 30, 1962

Institution	Location	Bachelor's Degrees	Master's Degrees	Ph.D. Degrees
Agnes Scott College	Atlanta	2		
Atlanta University	Atlanta		4	
Berry College	Rome	3		
Brenau College	Gainesville	1		
Clark College	Atlanta	2		
Emory University	Atlanta	22	13	2
Georgia Institute of Technology	Atlanta	65	10	8
Georgia Southern College	Statesboro	2		
Georgia State College of Business Administration	Atlanta	6		
Mercer University	Macon	2		
Morehouse College	Atlanta	7		
Morris Brown College	Atlanta	1		
North Georgia College	Dahlonega	1		
Savannah State College	Savannah	2		
Shorter College	Rome	1		
Spelman College	Atlanta	1		
Tift College	Forsyth	6		
University of Georgia	Athens	42	9	
The Woman's College of Georgia	Milledgeville	3	—	—
Total		169	36	10

Source: U. S. Office of Education, Earned Degrees Conferred, 1961-62.

A tabulation of 735 questionnaires received from members of the June 1962 Georgia Tech graduating class showed that 611 graduates (83.1%) preferred or were willing to accept employment in Georgia. Of this group, 56.2% were Georgia residents and 43.8% were non-Georgia residents.

Of the 240 graduates who definitely preferred employment in Georgia, 107 began their military obligations and 14 entered graduate schools. Fully 38% of the remaining 119 accepted positions outside the state -- presumably because suitable employment opportunities were not available in Georgia.

The preference of Georgia Tech graduates for employment in Georgia is further demonstrated by a second tabulation of 327 questionnaires received from selected Georgia Tech alumni, classes of 1946 to 1957. It showed that 91 had considerable interest in relocating in Georgia. This group included 17 with master's degrees and two with doctorates. Another 136 alumni (21 with master's degrees and one with a doctorate) were interested, but with qualifications.

Georgia Tech graduates alone compose a reservoir of qualified professional personnel totaling nearly 28,000.

The major asset in Georgia's present group of vocational and technical training schools is the Southern Technical Institute, a unit of the Engineering Extension Division of Georgia Tech. Its two-year programs graduate approximately 280 technicians each year in 11 areas of technology. Located on a new $2,500,000 campus in Marietta, Southern Tech has an enrollment of more than 800.

Table 27 summarizes a survey of salaries received by graduates of the Southern Technical Institute. The survey represents reports received from 985 (44%) of Southern Tech's alumni.

The 64 degree-granting colleges and universities in Georgia and the state's vocational-technical complex provide business and industry with a large and continuing supply of well qualified graduates. They further provide business and industry with an almost unlimited choice of courses of study for employed individuals.

Table 27

SALARY DATA FOR SOUTHERN TECHNICAL INSTITUTE GRADUATES

Year of Graduation	Number Reporting	Average Starting Salary per Month	Average Present Salary per Month	Difference
1949	29	$210	$751	$541
1950	67	239	695	456
1951	50	259	668	409
1952	39	278	623	345
1953	30	316	655	339
1954	48	295	643	348
1955	88	319	588	269
1956	114	341	567	226
1957	114	369	535	166
1958	105	355	487	132
1959	131	375	500	125
1960	170	373	403	30

Production Personnel

Labor Supply

To meet the growing need for chemical workers there is a minimum of 250,000 Georgians potentially available for industrial employment. The supply, comprising the unemployed, the underemployed, and housewives who could be attracted into the labor market, is geographically well spread across the state.

That the unemployed are readily employable is evidenced by the fact that the duration of unemployment is usually less than 12 weeks. The transportation equipment industry in Georgia is subject to wide variations in employment and is sometimes a source of large numbers of workers of high educational and skill levels who are willing to work at less than current transportation equipment wages to secure steady employment. The employment decline in the textile industry in Georgia has produced some labor surplus. These workers, while not equal in education to transportation equipment workers, should be readily adaptable to several production operations in the chemical industry. The unemployed also include migrants from depressed areas in other states.

The underemployed currently number about 120,000. These are people who receive only marginal incomes through minimum utilization of their skills and learning abilities. The total includes a large number of farm workers, due to mechanization and changes in the types of crops planted. Owners of small marginal farms who have been able to earn regular wages while continuing to farm on a part-time basis, have been mentioned by employers as showing outstanding productivity and stability.

A major -- and often overlooked -- source of experienced skilled labor is the vast number of workers that can be attracted to Georgia from the congested, highly industrialized, and often economically depressed areas in other sections of the country. The intersectional mobility of labor has not been fully appreciated by many, but the experience of those companies that have tried recruiting from other areas indicates that many skilled workers are anxious to take advantage of the climate, living conditions, and industrial opportunities that Georgia offers.

Wage Rates and Total Labor Costs

Gross hourly earnings in Georgia's chemical industry in March 1961 ranged between 72% and 82% of wages paid by the industry nationally, based on Bureau of Labor Statistics reports. More than 90% of Georgia's chemical industry employment is included in the subdivisions listed in Table 28.

Table 28

GROSS HOURLY EARNINGS OF PRODUCTION WORKERS IN THE CHEMICALS AND ALLIED PRODUCTS INDUSTRY, MARCH 1961

	Georgia	United States
All chemicals and allied products	$ 1.86	$2.54-2.56
Industrial inorganic chemicals	2.02-2.30	2.81
Plastic materials and synthetic and rubber fibers	1.68-1.92	2.34
Drugs	1.71-1.94	2.37
Soaps, detergents, and cleaning preparations	1.97-2.24	2.73
Paints	1.80-2.05	2.50
Gum and wood chemicals	1.51-1.72	2.10
Fertilizers	1.32-1.51	1.84
All manufacturing	1.66	2.30-2.32
Nondurable goods	1.62	2.09-2.12

Source: Bureau of Labor Statistics, Monthly Labor Review

Straight-time hourly earnings of $1.79 in the Georgia chemical industry can be approximated by adjusting to a 40-hour work week. The average hourly earnings figures given in Table 28 reflect an average work week of 43.2 hours in Georgia, about two more hours than reported by the industry nationally.

Data on local practices regarding overtime, late-shift, and incentive premiums are not available for the whole state, but they are known to be generally less liberal than in Atlanta, the largest industrial nucleus in the state. As shown in Table 29, the occurrence of daily overtime and late-shift pay practices by manufacturers in Atlanta are significantly below the average of 15 other areas, but weekly overtime and incentive pay provisions occur with nearly equal frequency in both groups. Also, while labor-management contracts are less common in Atlanta, life insurance plans and other supplementary employment practices occur more frequently.

Table 29

PREMIUM PAY AND SUPPLEMENTARY PRACTICES IN MANUFACTURING PLANTS, ATLANTA AND AVERAGE OF 15 OTHER AREAS[1/]

(July 1961 - June 1962)

	Percentage of Manufacturing Plant Workers	
	Atlanta	Average of 15 Other Areas
Workers covered by a labor-management contract (not a measure of labor organization membership)	55-59	81-85
Second-shift workers who received shift-pay differential (per cent of second-shift workers)	78	96
Third-shift workers who received shift-pay differential (per cent of third-shift workers)	77	97
Workers covered by a retirement pension plan at least partly paid for by the employer	55	73
Workers covered by a life insurance plan at least partly paid for by the employer	97	92
Workers covered by a hospitalization plan at least partly paid for by the employer	98	91
Workers covered by a sickness and accident insurance plan and/or sick leave	75	83

1/ Boston, Newark-Jersey City, New York City, Philadelphia, Birmingham, Memphis, Richmond, Chicago, Cincinnati, Indianapolis, Kansas City, Denver, Los Angeles-Long Beach, Portland, San Francisco-Oakland.

Source: Bureau of Labor Statistics, Wages and Related Benefits, 82 Labor Markets, 1961-62

Another component of total labor costs is paid leave time. Generally southern workers receive less paid vacation time and paid holiday time than workers in other regions. (See Table 30.) Net effect of these practices is that workers in the South spend a greater part of total hours paid at work in the plant than do workers in other regions.

Table 30

PLANT MAN-HOURS AND HOURS OF PAID LEAVE AS PERCENTAGES OF TOTAL HOURS PAID, FOR PRODUCTION AND RELATED WORKERS IN MANUFACTURING (1959)

	Total Hours Paid	Plant Man-Hours	Hours of Paid Leave				
			Total	Vacations	Holidays	Sick Leave	Other
U.S.	100.0	94.1	5.9	3.4	2.2	0.2	(a)
Northeast	100.0	93.8	6.2	3.5	2.4	.2	(a)
South	100.0	95.5	4.5	2.8	1.4	.2	(a)
North Central	100.0	93.6	6.4	3.8	2.3	.2	(a)
West	100.0	94.3	5.7	3.2	2.1	.4	(a)

Notes: "Other" includes military, jury, witness, voting, and personal leave.
(a) = less than 0.05 per cent.

Source: Bureau of Labor Statistics, Employer Expenditures for Selected Supplementary Remuneration Practices for Production Workers in Manufacturing Industries, 1959

Work Stoppages

Labor relations in Georgia, measured in time lost through work stoppages, are outstandingly good. Georgia nonagricultural workers were involved in only 28 new work stoppages during 1960, while nationally there were 3,333 new stoppages. Idle man-days caused by strikes represented 0.17% of estimated total national working time in 1960, but Georgia had only 0.05% of total working time lost in labor-management disputes. Only nine states (seven of them in the South) and the District of Columbia, reported lower percentages.

Labor Laws and Regulations

The following labor laws and regulations affect the employment of production personnel in Georgia.

Right to Work Law. Under provisions of this law enacted in 1947, every individual has freedom of choice as to whether or not to join a labor union. It is illegal to use force or threats to prevent another person from quitting or continuing employment. It is unlawful to gather at or near the scene of a labor dispute to prevent persons from engaging in lawful work.

Employment Security Law. Unemployment insurance tax is levied upon employers of four or more persons. The tax ranges from 2.7% of payroll to as low as 0.25%, based on the firm's "experience rating."

Workmen's Compensation Act. The law applies to employers of 10 or more employees; coverage is optional.

Wage-Hour Law. There is no State law as such, but employment in certain types of textile plants is limited to 10 hours per day.

Child Labor Laws. No person under 16 years of age may be employed or permitted to work in industrial plants.

Health and Safety Laws. Every employer is required to provide a safe place in which to work and to use such safety devices, safeguards, and methods as required to protect the life, health, and safety of employees.

Part III

CHEMICAL MANUFACTURING OPPORTUNITIES IN GEORGIA

IDENTIFICATION OF CHEMICAL MANUFACTURING OPPORTUNITIES

A few of the many opportunities for profitable manufacture of chemical products in Georgia are presented in this chapter. Each of the presentations was abstracted from published or unpublished analyses prepared by the Industrial Development Division in partial fulfillment of contract obligations to state or local development agencies or private companies.

Most of the products discussed here are formulated products -- finished products which are mixed or otherwise blended from chemical components and distributed to the ultimate consumer. It is because of their consumer market orientation that formulated products have been emphasized in establishing the Division's project priorities. Because Georgia is the natural center of any southeastern market related to the distribution of population, there is little chance that funds assigned to studying a consumer market oriented product would be wasted. Abstracted in this chapter are reports on detergents, waxes and polishes, toiletries, pharmaceutical preparations, antibiotics, and paint.

The Division has generally tailored analyses of industrial market oriented products to the needs of individual companies. Pulp and paper manufacturers and textile manufacturers comprise the major industrial markets in the area, but the needs of Georgia's growing formulated chemical product complex should not be overlooked. There is also a large market for agricultural chemicals. One obvious manufacturing opportunity is synthetic fibers; an analysis of the feasibility of manufacturing synthetic fibers in Georgia is scheduled for publication in early 1964. Chlorine and caustic soda production is another possibility; a survey of the area market for these products is abstracted in this chapter.

Recently the Division has initiated a series of reports on products which are generally considered to be raw material oriented, but which in fact can be more profitably produced in Georgia than at raw material outlets. The combination of large and growing markets and low cost transportation for bulk commodities has made it more profitable to transport raw materials to a market oriented site than to transport the finished product from a raw material oriented site. An abstract of a report on the profitability of synthetic rubber production in Georgia provides an example. Other chemicals in this

category are suggested in the section entitled "Natural Gas Products." They include methanol, formaldehyde, and methylamines; acetylene and acetylene chemicals; and methylene dichloride and perchloroethylene.

Most of the published reports which have been abstracted here are available on request from the Industrial Development Division. Specific information pertinent to individual companies will be prepared in confidence on request. Requests for thorough analyses of other products will be welcomed.

PRODUCTS ORIENTED TO CONSUMER MARKETS

Liquid Detergents[1/]

Packaged liquid synthetic detergents for home use are becoming increasingly popular; consequently, it will be necessary for national manufacturers to increase production capacity. A market survey conducted in 1958 showed consumption for Georgia and five surrounding states (Alabama, Florida, North Carolina, South Carolina, and Tennessee) to be about 61.5 million pounds annually. Consumption was expected to reach 217.6 million pounds by 1964.

Because liquid synthetic detergents contain roughly 50% water, transportation costs are an important part of total costs. In fact, transportation cost savings accruing to a plant serving the six-state area from Georgia make it more attractive to build a totally new plant in Georgia than to build additional manufacturing capacity at a northern site or to convert existing plant space to facilities for the manufacture of liquid detergents.

For example, transportation savings for a Georgia plant with capacity exceeding 30 million pounds per year would pay for the additional cost of a Georgia facility (compared with the cost of expanding facilities at Baltimore, Maryland) within about one and one-half years. Transportation savings would offset the extra cost for a much smaller Georgia plant (capacity exceeding 15 million pounds per year) in approximately three years.

Household Waxes and Polishes[2/]

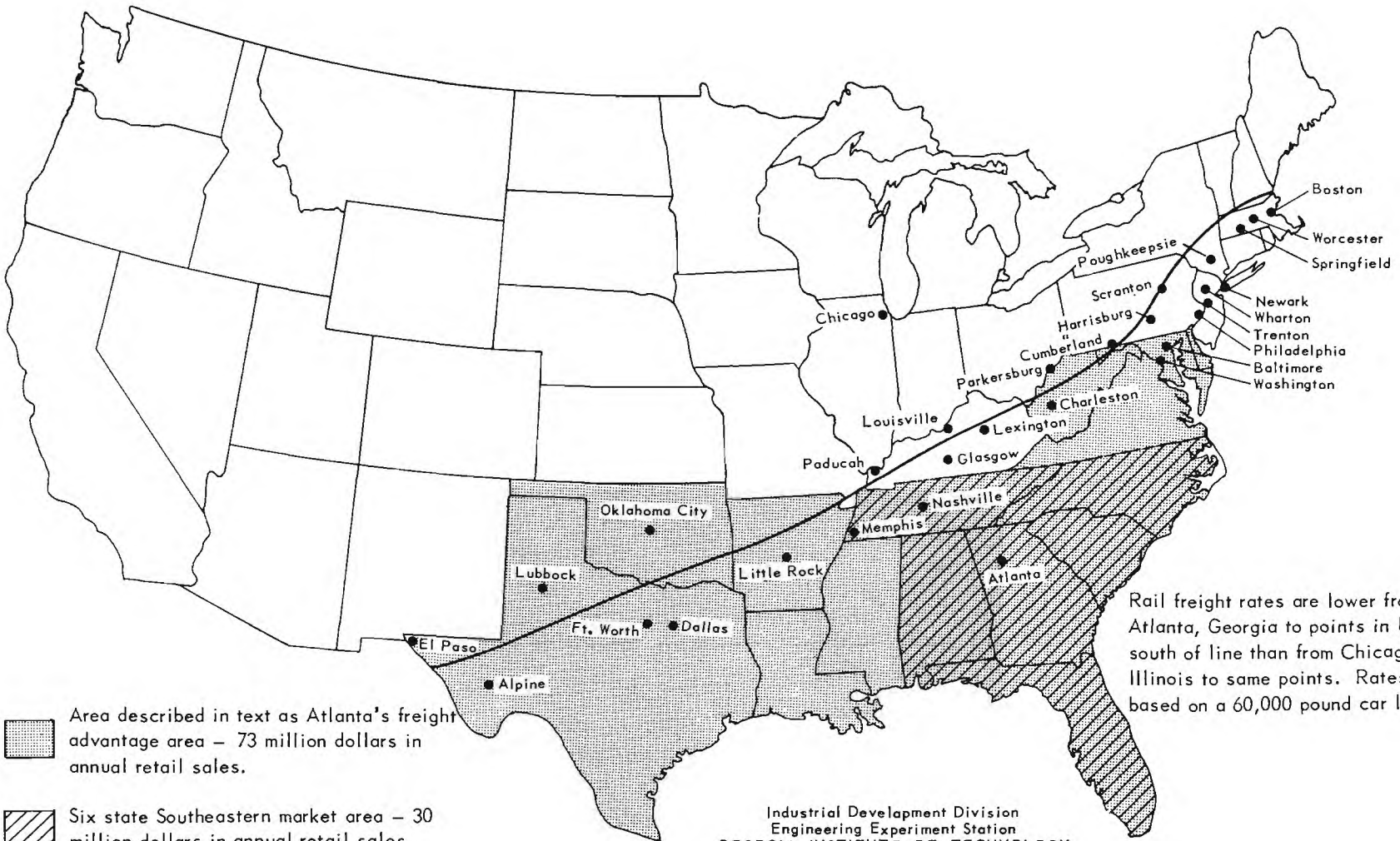
Atlanta can ship household waxes and polishes at less cost than Chicago to a 16-state area extending from Texas to Massachusetts. (See Map 25.) The area retailed $73 million worth of household waxes and polishes in 1960, and sales are expected to reach $84 million by 1967.

1/ Abstracted from Liquid Detergents: A Manufacturing Opportunity in Georgia, by Robert E. Van Geuns, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, February 1960.

2/ Abstracted from Household Waxes and Polishes: A Manufacturing Opportunity in Atlanta, by Wade McKoy, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, May 1962.

MAP 25

AREA WHERE FREIGHT COSTS ON HOUSEHOLD WAXES AND POLISHES WILL BE LESS FROM ATLANTA, GEORGIA, THAN FROM CHICAGO, ILLINOIS



Rail freight rates are lower from Atlanta, Georgia to points in U.S. south of line than from Chicago, Illinois to same points. Rates based on a 60,000 pound car load.

Area described in text as Atlanta's freight advantage area – 73 million dollars in annual retail sales.

Six state Southeastern market area – 30 million dollars in annual retail sales.

Industrial Development Division
Engineering Experiment Station
GEORGIA INSTITUTE OF TECHNOLOGY

A plant in Atlanta with wholesale sales of $4 million could expect savings over a comparable plant serving the area from Chicago of $80,000 in freight costs, $46,000 in labor costs, and $25,000 in property taxes. Excluding additional savings that would accrue from Atlanta's lower construction costs, lower natural gas rates, and lower electric rates, the quantified savings would exceed $150,000 annually.

Earnings after Federal income taxes would be about $72,400 higher for an Atlanta plant than for a Chicago plant. Since after-tax earnings of a Chicago plant are likely to approximate $81,000 per year, the $72,400 additional earnings for an Atlanta plant represent an increase of almost 90%.

Wholesale sales of $4 million would require a 10% penetration of the 16-state wholesale market for household waxes and polishes.

Toiletries[1/]

Although markets for toiletries are spread throughout the United States, almost 83% of production is concentrated in the northern manufacturing belt. Retail sales of toiletries in the South exceeded $380 million in 1961, more than nine times the area's production.[2/]

The imbalance between sales and production in the South does not mean that the market is wide open for manufacturers of new brands. It does mean that established proprietary producers are missing an opportunity to increase earnings on sales. Considering only those major savings that can be readily quantified, a company presently producing in the New York area could increase earnings on sales in the South by 30% by serving the southern region from a plant in Georgia. On sales of $20 million in the South, a Georgia plant would save $263,000 in freight costs, $420,000 in labor costs, and $36,000 in property tax, or total savings of $719,000 from just these three elements of expense.

1/ Abstracted from Toiletries: A Manufacturing Opportunity in Georgia, by Wade McKoy, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, January 1963.

2/ Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Texas.

The projected rapid growth of the toiletries industry provides a second motive for locating a manufacturing operation in Georgia. Retail sales of toilet goods in 1961 were almost $2 billion and have been growing at an average annual rate of 7.8% since 1951. By 1967, sales are expected to reach $3.2 billion -- a 65% increase over 1961. Sales in the South should exceed $630 million by 1967.

Pharmaceutical Preparations[1/]

Over a billion dollars worth of pharmaceutical products for human use were retailed in the Georgia freight advantage area in 1962. (See Map 1.) Converted to manufacturers' sales prices, the market totaled over $530 million -- 23% of total U. S. sales. The area produced less than 6% of the total U. S. output in that year.

A branch plant serving the southern market from Georgia would pay from 37% to 75% less in freight fees than plants serving the area from Chicago, Los Angeles, or New York. Savings on production labor accruing to a Georgia plant would range from 24% to 30% of the production labor cost in Illinois, California, or New York. Additional savings could be realized from Georgia's lower taxes, lower utility costs, and lower construction costs.

A Georgia plant need not be limited to serving a southern market, however. National markets could be served more economically from a Georgia plant than from plants in Illinois, New York, or California. Plants in the major city of each of the four states could expect freight bills as a per cent of plant sales as shown on the following page.[2/] While Chicago would have the lowest distribution cost, an Atlanta plant would actually earn 11% more than a Chicago plant because of Atlanta's lower production costs.

1/ Abstracted from Pharmaceutical Preparations: A Manufacturing Opportunity in Georgia, by Wade McKoy, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, December 1962.

2/ The destination points for shipments from the plants are the principal cities of the 37 wholesale drug areas of the continental United States as defined by the National Wholesale Druggists' Association. Freight bills were calculated for the actual sales in each area.

Plant Location	Freight Bill as a Per Cent of Plant Sales
Chicago	1.39
Atlanta	1.52
New York	1.67
Los Angeles	3.34

Judgments related to economic plant size for the pharmaceutical preparations industry can be drawn from statistics presented in the 1958 Census of Manufactures on SIC 2834. One comparison shows that the average annual salary paid per employee varies directly with the number of employees; the larger the number of plant employees, the higher the average annual salary. Another comparison shows that productivity (value added by manufacture per dollar of payroll) reaches a maximum when employment is between 100 and 250; productivity drops off sharply for plants with employment exceeding 1,000 and continues to decline as employment is increased. A third comparison shows that production per employee is highest when employment is between 100 and 1,000; as employment is increased beyond 1,000, production per employee drops.

The three comparisons indicate that plants with more than 1,000 employees would be more productive if operations were decentralized. Some 14 plants in the U. S. have employment exceeding 1,000.

Antibiotics[1/]

The antibiotics industry will need to construct additional facilities to supply its rapidly expanding markets. The tonnage of antibiotics sold in the U. S. increased almost 170% between 1951 and 1960. Manufacturers' sales are expected to increase from $431 million in 1958 to $750 million in 1968.

The size of an antibiotics complex at a given site is limited by the availability of process cooling water and by the facilities available for disposal of wastes. If manufacturers are to serve the rapidly expanding market for antibiotics, they must eventually choose between establishing new sites or purchasing additional water cooling and waste processing facilities.

1/ Abstracted from Antibiotics: A Manufacturing Opportunity in Atlanta, by George W. Morris, Jr., Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, May 1962.

Several areas in Georgia have sites suitable for antibiotics manufacture. For example, the Chattahoochee River south of Buford Dam has a low and relatively stable temperature. According to the U. S. Army Corps of Engineers, the average monthly temperature of Chattahoochee River water at a point 30 miles northeast of Atlanta ranged from a low of 47° F. in March to a high of 50° F. in August 1961. According to a leading authority on water pollution in Georgia, the Chattahoochee has a relatively low rate of pollution and, at a point 10 miles southwest of Atlanta, could easily handle the volume of antibiotics waste of most producers. However, since the content and volume of waste materials varies between individual companies, the need for a filtering pond and equipment would have to be studied on a company basis.

A plant in Georgia could save on expenses as well as on investment. A producer with annual sales of $9 million could expect production labor costs to be $150,000 to $600,000 less than those of comparable plants in the North.

A plant located near Atlanta would have access to a concentration of research and educational facilities and to outstanding transportation facilities for both goods and people. In addition, Atlanta is a large market for drugs, wholesaling $233 million worth in 1958. New York, Chicago, and Los Angeles were the only cities with higher sales in that year.

Paint[1/]

The Southeast supplies less than half of its own demand for paint. Consumption in the six-state market composed of Georgia and the five surrounding states exceeded production by 25 million gallons in 1958.

While paint consumption in the country as a whole has increased at a rate of about 1.7% per year, consumption in the six-state area has increased at a rate of 3.1% per year. Consequently, the area's share of the total U. S. paint market increased from 7.6% in 1947 to 8.6% in 1957. This increase is expected to continue because of the rapid rise in income per family in this area, the great construction activity, and the continuing industrial expansion.

1/ Abstracted from Paint Production: A Manufacturing Possibility for Small Georgia Communities, by William C. Eisenhauer and Robert E. Van Geuns, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, December 1959.

Because of increasing demand in the area and because transportation costs on paint favor decentralization of the industry, additional production facilities probably will be constructed in the Southeast. Manufacturers selecting Georgia sites will have the advantage of access to Atlanta, the most important distribution point for paint-making materials and manufacturing equipment in the Southeast.

These conclusions are confirmed by Sherwin-Williams' plans to complete a plant near Atlanta which will ultimately produce seven million gallons of paint per year. Another national firm with a plant in Georgia has enjoyed a 16% to 22% annual increase in paint output.

PRODUCTS ORIENTED TO INDUSTRIAL MARKETS

Chlorine and Caustic Soda[1/]

A 1963 market survey of selected consumers in Alabama, Florida, Georgia, and South Carolina showed an annual consumption of 220,507 tons of chlorine and 480,172 tons of caustic soda. The survey excluded the non-merchant market and users who are known to buy over-the-fence from a single supplier.

Totals were tabulated from questionnaire or telephone contacts with 238 firms, or 52% of the 459 firms originally contacted. They are believed to account for 85% of the total merchant consumption in the area. Selected data from the survey are presented in Table 31.

Table 31

ANNUAL CONSUMPTION OF CHLORINE AND CAUSTIC SODA
IN FOUR SOUTHEASTERN STATES

Survey Total	Total	Alabama	Florida	Georgia	South Carolina
Chlorine (tons)	220,507	63,112	45,884	91,357	20,154
Caustic soda (tons)	480,172	219,533	60,311	113,666	86,662
Number of users who responded	173	38	19	86	30
Pulp and Paper Industry					
Chlorine (tons)	158,881	59,817	33,004	48,960	17,100
Caustic soda (tons)	170,154	53,226	46,365	52,676	17,887
Number of mills in survey	45	12	14	12	7

The pulp and paper industry is the largest market segment in the four-state chlorine-caustic soda market. It used 64% of the chlorine and 30% of the caustic soda in the four-state market in 1963. Forecasts of consumption by the four-state pulp and paper industry indicate the following markets:

1/ Summarized from the files of the Industrial Development Divison, Engineering Experiment Station, Georgia Institute of Technology.

	1963	1965	1968
Chlorine (tons)	158,881	197,440	280,000 or more
Caustic soda (tons)	170,154	203,893	280,000 or more

The forecasts for 1968 are based on the opinions of research directors, planners, mill managers, and economists in the paper industry. Figures for 1965 include only presently planned new construction, expansions, and conversions to bleached pulp.

PRODUCTS ORIENTED TO RAW MATERIALS

Synthetic Rubber[1/]

The cost of producing synthetic rubber would be about 20% higher in Georgia than in Texas, but because of savings in product shipping costs, a Georgia plant could deliver to a large part of the U. S. synthetic rubber market more cheaply than a Texas plant. The market advantage area includes all or part of the Atlantic Seaboard states from Florida to Massachusetts, and most of West Virginia, Ohio, Kentucky, Tennessee, and Alabama. In addition, Georgia is in the center of the rapidly growing southeastern market, whose 160 rubber goods manufacturing establishments presently consume 13% of the synthetic rubber used in the United States.[2/]

Higher manufacturing costs in Georgia stem exclusively from higher delivered feed stock costs -- about 0.6 cent per pound higher than in Texas. Processing costs are actually about 0.3 cent per pound lower in Georgia (about 0.2 cent lower labor costs and 0.1 cent lower taxes). The bulk cost of polymerized product would be about 0.3 cent per pound higher in Georgia than in Texas.

Freight costs of a Georgia plant would be lower than those of a Texas facility on shipments to almost the entire market east of the Mississippi River; savings would be particularly significant on shipments to the large southeastern market. Higher Georgia finished product costs merely confine the actual delivered cost advantage area to the 18-state area described previously.

1/ Abstracted from Synthetic Rubber: A Manufacturing Opportunity in Georgia, by Wade McKoy, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, December 1962.

2/ Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee. The rubber market in this area has been growing at five times the U. S. rate.

Natural Gas Products[1/]

Although no detailed analyses of the economics of producing chemical intermediates from natural gas in Georgia have been made, several possibilities are suggested here because:

1. The southeastern market for them is large and growing.
2. Natural gas prices in Georgia generally are lower than in more northern states along the natural gas pipelines. (Plants consuming at least 50 million cubic feet per month can purchase interruptible natural gas for 26 cents per thousand cubic feet in many locations in Georgia.[2/])
3. Economic analyses of products with similar production and distribution requirements have demonstrated that, because of rising transportation costs on chemical intermediates, products which have traditionally been considered to be raw material oriented are now market oriented.

The examples given here include methanol, formaldehyde, and methylamines; acetylene and acetylene chemicals; and methylene dichloride and perchloroethylene. Ammonia is already produced from natural gas in more than one plant in Georgia.

Methanol, formaldehyde, and methylamines have large markets in the Southeast. The fact that all three chemicals are presently produced in the Southeast demonstrates the economic and technological soundness of manufacture in the area. Methanol, the only chemical of the group which is made directly from natural gas, is presently produced in Florida.

The chief outlet for methanol is in the manufacture of formaldehyde, which finds markets in the manufacture of resins, pentaerythritol, ethylene glycol, and hexamethylenetetramines. Formaldehyde is made in Alabama and North Carolina. The manufacture of methylamines from methanol also requires ammonia,

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1/ Abstracted from Chemical and other Manufacturing Possibilities for the Central Savannah River Area, by William C. Eisenhauer, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia, July 1963.

2/ The original report abstracted here quoted a price of "less than 28 cents per thousand cubic feet." Subsequent to its publication, the Industrial Development Division has received permission to quote a natural gas rate of 26 cents, which will be published in early 1964.

which is presently produced in Georgia. Used in the manufacture of pesticides, textile chemicals and detergents, methylamines are currently produced in Tennessee and Florida.

Acetylene is an unusually versatile chemical building block. Because it is difficult to ship acetylene, both acetylene and acetylene products should be made at the same location. Acetylene products with markets in the Southeast include acrylates, vinyl chloride, and vinyl acetate. A complex producing these products probably could compete with the bigger and lower cost operations on the Gulf Coast because freight savings could run as high as 1.3 cents per pound on products costing less than 10 cents per pound. This saving would more than offset the acetylene production cost disadvantage which a Georgia plant would have.

Methylene dichloride, widely used in formulating paint and varnish removers, and perchloroethylene, a leading dry cleaning solvent, have large southeastern markets. Although the reaction between chlorine and methane in the presence of light or a catalyst yields four substitution products -- methyl chloride, methylene dichloride, chloroform, and carbon tetrachloride -- it probably would be desirable to recover only methylene dichloride and carbon tetrachloride in large amounts, while recyling the remaining two chloromethanes to the chlorinator. Perchloroethylene, formed by pyrolysis from carbon tetrachloride, and methylene dichloride would then be available for the southeastern market.